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August, 1932

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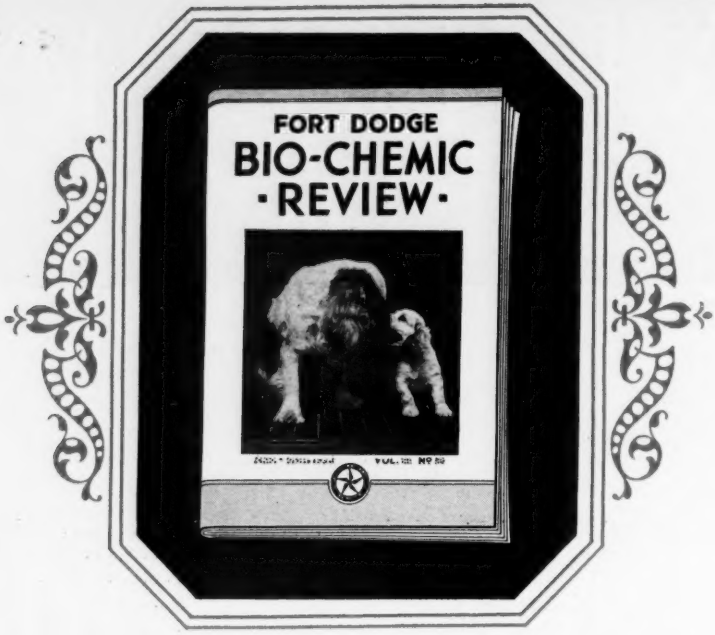

GREETINGS, FRIENDS:

THIS month we have presented — with pardonable pride —a new and enlarged Fort Dodge Bio-Chemic Review, attractively designed in distinctive modern style.

The style of the contents is unchanged. There are no long, general, theoretical discussions on theories of veterinary practice; but, instead, concise, definite, practical articles on the specific problems which veterinarians have to meet—all written in a warm, friendly style. (Many of our friends tell us they keep their copies as they appear, for ready reference work.)

We believe we have nearly every practicing veterinarian on our mailing list to receive the Bio-Chemic Review free of charge. However, if by chance you are not now getting copies regularly, please let us know so that we may enter your name on the list. Of course, there is no charge or obligation.

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D. M. Campbell, Editor A. T. Kinsley, Associate Editor

Efficient pasteurization for three minutes at a temperature of 62°-63° C is sufficient to destroy the *Br. Abortus,* either bovine or porcine, according to Murray and associates of Iowa.

On the productions of the earth, such as fruits (grain), weeds (forage), and grass, the horse and the ox grow, live, free of disease and require no other kind of food.—Hippocrates.

In acute diseases it is not quite safe to prognosticate either death or recovery.—Hippocrates. That is to say, do not treat any febrile disease as being slight nor abandon any one as hopeless.

A black discolorization of the cecum and colon is occasionally observed in swine. This condition has little or no pathologic significance. It is an accumulation of iron sulphide in the intestinal wall, according to Anthony and his colleagues. (Bio. Abst. 7364-1932.)

A deficiency disease in cattle, primarily in cows during the lactation period, that were pastured on upland clay soil in Guam is called Matai tati disease. This condition is apparently a phosphorus deficiency or at least it is prevented by feeding bone meal. (Exp. Sta. Rec. Vol. 66, No. 5.)

The use of 5 to 10cc of pyrethin in oil was found to be of considerable value in the control of bovine verminous bronchitis, according to Ricaud and Camus. The pyrethin oil mixture was injected intratracheally and produced no unfavorable results. In cases in which the disease was advanced it may be necessary to repeat the injection. (Exp. Sta. Rec. Vol. 66, No. 5).

Karakul sheep are native of West central Asia. There have been three importations of these sheep into the United States and pure-bred Karakuls are therefore not very numerous. This breed of sheep are of particular value in the production of lambskins suitable for fur. The karakul sheep are hardy and it is probable that cross breeding of the karakul ram and native ewe would produce a hardy type that would be profitable.

Stomach worm eggs under favorable conditions may reach the infective stage within four days after the eggs have been eliminated from infested sheep. Pastures may remain infested for 12 months, after all sheep have been removed. A non-infested sheep may begin eliminating stomach worm eggs within 18 days after being placed on infested pastures or lots, therefore treatment should be applied every 17 days.

Veterinary practitioners state that, by reason of financial conditions on the farms and lesser values of swine, many hog growers are quick to lose interest in their droves of pigs when ailing. In cases of infectious diseases of swine, especially hog cholera, the lack of efficacious measures to stop losses makes the centers of infection more of a menace. Animals sick with infectious diseases throw off many billions of disease producing germs from body openings, including the eyes. These seeds of disease are readily carried from farm to farm by many agencies. such as dogs, birds, flies, men's shoes, horses' hoofs, wagon wheels, etc. The more sick animals and the longer a time it takes for a sick drove to die and be buried, the greater the number of germs produced and the greater the menace. Coupled with the production of more germs through disinterested owners, the same lack of interest and care may prevent proper disposal of carcasses and add to the menace. Rendering plants being unable to operate and gather up carcasses as formerly makes more difficult the proper disposal of carcasses on the farms. It appears that there is prospect of the widespread dissemination of infectious diseases among swine and other livestock. —Eastern Iowa Vet. Med. Assn. *News Bulletin.*

One Method of Contaminating Milk

HISTORICAL BLOOD TRANSFUSIONS

The history of blood transfusion dates back to the discovery of the circulation of the blood by Harvey. The operation was conceived of even before that time, for Pemberton refers to the first transfusion as given to Pope Innocent VIII in 1492 by a Jewish physician. The three boys used as donors died, as did the Pope later. According to Herr, the blood was probably given by mouth. Blood transfusion from animal to animal was first successful in the hands of Lower in 1666 in England. In 1667, Denys in France, and Lower and King in England carried out the first transfusion of blood from animals to man. The first transfusion with human blood was probably made by Blundell during the first half of the 19th century.

Needless to say, many fatalities occurred in those days, for the technique of blood grouping was not discovered until 1901. Landsteiner was the first to observe the phenomenon of iso-agglutination as such, and showed that it was not only independent of disease, but was a normal reaction of human blood. On the basis of his observations in cross-agglutination he concluded that all human blood could be divided into three groups, which he called A, B, and C. Although v. Decastello and Sturli in 1902, and Hektoen in 1903, found exceptions to the classification of Landsteiner, they did not designate them as a fourth group, and it was not until 1907 that the existence of four groups was first reported by Jansky. In the same year, Moss, working independently, also discovered a fourth group, but later conceded priority of discovery to Jansky.

The number of blood groups depends on the existence in the red cells of substances having two different structures, either or both of which may be present or absent in the red cells of a given individual. These substances are called iso-agglutinogens and are designated A and B. The presence or absence of one or

both isoagglutinogens in the red cells would not be sufficient to explain the reactions between the red cells and the sera; the active substances of sera, isoagglutinins (designated α and β) must also occur in a definite distribution. This actually is so for every serum contains those isoagglutinins which act upon the isoagglutinogens not present in the red cells.—George J. Braucato in the *Medical Times.*

STUDIES OF FOWL PARALYSIS

In a study of fifty outbreaks of paralysis among chickens, including nineteen outbreaks exhibiting nerve lesions, Blount found that at least 90% of these cases were associated with an improper functioning of the gizzard due to a deficiency of insoluble grit, like flint, in the diet. Inflammatory changes occurred in the alimentary canal, notably in the duodenum, and in the majority of instances intestinal paralysis followed. In the study of the prevention of the disease, fowl paralysis, and also of associated paralyses exhibiting as their sole feature numerous intestinal parasites, careful consideration should be given to the management of such birds throughout life in order to insure that grit suitable for the optimum functioning of the gizzard shall be supplied at all times to be ingested. Except in the case of birds occupying light "gravel" soils, flint grit should be broadcast over the land periodically. Care should be taken to insure that a bird's natural appetite for grit does not become dull because of the presence of an excess quantity of soluble calcium salts in the ration. It is suggested that birds reared intensively without a proper supply of grit suitable for grinding purposes, or reared on range inadequate in this respect, prepare themselves for future intestinal parasitic infestations by lowering the vitality of their digestive tracts.—*The Veterinary Journal.*

SAVING PEOPLE FROM BOVINE TUBERCULOSIS

Milk from tuberculosis cattle causes at least 4,000 cases of tuberculosis annually among people in England and Wales where the population is about 40,000,000. About 2,000 deaths, mostly among children, result annually from tuberculosis of bovine origin. About 6% of all deaths of humans from tuberculosis are caused by the bovine type of bacillus. About 6.7% of the raw milk sold in the markets of England and Wales contains living tubercle bacilli. At least 40% of the cows in that country are infected with tuberculosis though only a minority of these are infective.

These conclusions are drawn by a committee which has studied the milk problem with great care and reported its finding recently. The report is reviewed in the March 19, 1932, issue of The Lancet which says of the committee, "that no more representative or competent body could possibly be collected in this country to study this matter."

These data applied to Illinois suggest how much tuberculosis is being prevented in this state through tuberculin testing of herds and through the pasteurization of milk. More milk is consumed per capita in Illinois than in England. Some of the milk sold in England is pasteurized. The population of England and Wales is about six times that of Illinois. Taking all of these factors into account it appears that the elimination of tuberculosis from the dairy herds of Illinois and the pasteurization of milk prevents in this state at least 1,000 new cases of tuberculosis and at least 500 deaths from this disease annually. This correlation is on the assumption that tuberculosis in the herds in Illinois would be equivalent to that in England. Other studies have indicated that fully 3,000 new cases in humans are prevented annually by the control of bovine tuberculosis.

Even the lower estimates make the preventive work of inestimable value.—*Illinois Health Messenger.*

Biological Analysis of Commercial Dog Foods

By JOHN W. PATTON, East Lansing, Michigan

IN A previous article[1] attention was called to the chemical analysis of several representative brands of dog foods. Attention is now called to their biological value.

Feeding knowledge can be divided into three periods:

1. The chemical period
2. The energy period
3. The biological period

It is in the latter period that we are at present. We are more concerned now with the protein after digestion than with protein as such. We no longer believe that vegetable and animal proteins are of equal value nor that proteins from all animal sources are adequate and equal. We now are concerned more with unseen vitamins, minerals and amino acids than with chemical analysis.

The term "balanced food" is rather loosely used when applied to the average dog food. The requirements for growth and maintenance, particularly maintenance, during gestation and lactation are not adequately met in many of the commercial dog foods which came under the writer's attention. We can expect little else while the stress is placed on chemical analysis and the biological values are ignored. It is pertinent to recall to memory the position diet holds in relation to health and disease. In man or beast its adequacy or insufficiency may well be observed from birth to death. It is immutable that a food is no better balanced than its constituents permit and no more adequate than their source.

The reason for the biologic difference of various proteins is due to their constituent amino acids. These amino acids have been called the building stones of the protein molecule. Nature always builds the same protein exactly alike as to its amino acids, but not all proteins have the same amino acid constitution or in like amounts. In some she leaves out, entirely, one or more amino acids and varies others as to amounts. This makes the structure of proteins quite complex, in fact the number of possible combinations is tremendous. When the linkage which holds the protein molecule is broken down in digestion the constitu-

SUMMARY OF METABOLISM OF FOODSTUFFS (Bogert)

Foodstuff	Delivered to tissues as	METABOLISM	
		Anabolism	Catabolism
Carbohydrates	Glucose	Glycogen Fat	Carbon dioxide energy and water
Fats	Fat	Fatty tissue	Carbon dioxide energy and water
Proteins	Amino acids	Tissue protein Glucose	Carbon dioxide energy and water Nitrogenous substances excreted in urine

[1] "A Study of Commercial Dog Foods," VET. MED., Vol. XXVII, 5, 204.

ent amino acids are available—those needed by the organism are available, while others are used for heat and energy or eliminated in the urine. Not all of the amino acids have to be present in the food, apparently some are made, as it were, from odds and ends of protein metabolism; however, only the simpler ones are procurable in this way. These amino acids are utilized by the organism in its nitrogenous metabolism. Proteins are classed as complete or incomplete, according to whether or not they furnish the animal with essentials for growth, maintenance and proper functioning of the body. Proteins alone are not the only consideration in these respects, as vitamins and minerals are important in their own way. A diet lacking in essential amino acids may hold up growth or even maintenance of the adult body for ordinary metabolism.

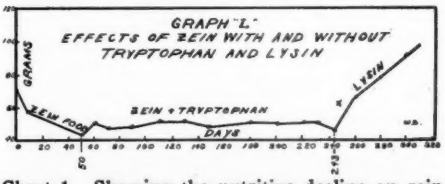

Chart 1. Showing the nutritive decline on zein food maintenance after the addition of tryptophan and growth after addition of both tryptophan and lysin. It is interesting to note that the capacity to grow and ultimately reach adult size was not lost after the extended period on a maintenance only diet.—Courtesy of W. B. Saunders & Co.

Biological Values of Different Proteins

Measured by the percentage of body protein which their ingestion will spare from loss. (From Lusk.)

Ox meat	104
Milk	100
Fish	95
Rice	88
Potatoes	79
Yeast	71
Casein	70
Spinach	64
Peas	56
Wheat flour	40
Corn meal	30

Protein holds a specific position—it is the source of nitrogen for the organism. All of life's processes are bound up with protein; it plays a conspicuous part in the cellular drama. One of the most interesting things about protein compounds is that they exist in so many different forms. It is frequently specific in its molecular structure and some of these specifications are almost strictly confined to single organs. The problem of metabolism in general and protein metabolism in particular is one of the most complex in physiology.

Minerals

Only five of the thirteen elements which enter into the composition of the body are present in the proteins, carbohydrates and fats which supply the energy and fuel needs of the body. These are carbon, hydrogen, oxygen, nitrogen and sulphur. The other eight must come from the ash constituents found associated with foods as they occur in nature. As a general rule, highly milled and refined foods are lacking in ash. The mineral elements according to the proportion in which they occur in the body are: Oxygen, carbon, hydrogen, nitrogen, calcium, phosphorus, sodium, potassium, magnesium, sulphur, chlorine, manganese, iron and iodine. Oxygen constitutes over half of the body weight while oxygen and hydrogen account for three quarters due to the large amount of water in the animal body. Iron, which makes up only one part in 25,000, and iodine, which occurs in 1% of that of iron, are indispensable to normal metabolic processes. As a general thing, the body cannot store any material amount of mineral elements. Insufficiency over a period of time is bound to manifest itself in some damage to the organism. Of these, iron, iodine, manganese, calcium and phosphorus are quite apt to be those lacking unless provision is made for their inclusion in the diet. Sodium and chlorine are usually supplied in the form of sodium chloride. Sulphur is a common ingredient of proteins—some proteins contain also phosphorus.

Milk and egg yolk contain phosphorus bearing proteins as does the outer coat of cereals. Green vegetables and egg yolk are two of the best sources of iron; iodine can be supplied adequately with iodized salt.

Nutrition During the Reproductive Cycle

The production of a new organism in the mammal raises many questions from the point of view of physiology. A pertinent consideration is the nutrition of the maternal organism as well as that of the fetus. It must be remembered that the fetus is essentially a parasite and unless the diet of the mother is adequate for both it will draw on her body for sustenance. The diet should be adequate to meet the needs of the mother and the growing fetus and possibly afford some reserve. If it is adequate there is no loss in the nitrogen balance—in fact, there may be a storage of nitrogen. During lactation, however, augmented food supply is necessary in order to maintain nitrogen balance—25% at parturition and increasing to 100% during the fourth week of lactation. Before parturition there may be a deficiency of some vital elements—but no direct loss—the mother can and does reabsorb under such conditions, whereas, during lactation the loss is from the body and usually in increasing amounts and presents a more serious problem than during gestation. Thus, from a nutritional point of view inadequacies are more serious during lactation than during gestation. It is in this respect that too many of our commercial dog foods prove inadequate. Nature takes care of this by interfering with the reproductive organs of both sexes where deficiency is at all serious. She takes care of insufficiency *in utero* by reabsorption of the fetuses and by cannabalism at birth.

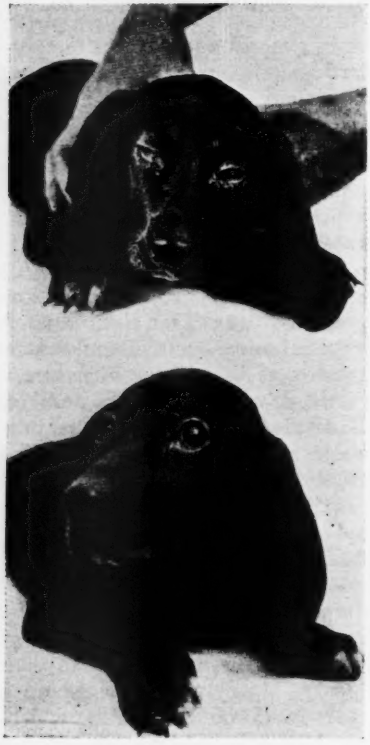

Fig. 1. (Above) Xerophthalmia in a puppy due to feeding a diet deficient in vitamine A. (Below) Full recovery after the administration of vitamine A. —Courtesy of Drs. Steenbock, Nelson and Hart

Proteins, vitamins and minerals play an important *rôle* in the reproductive cycle. Some experiments by Dagg's[2] employing four proteins, muscle meat, liver, egg and kidney, and used in connection with diets otherwise adequate, proves the influence of protein on the reproductive cycle in dogs. The number of young born, their growth, maternal nitrogen balance, as well as blood and urine analysis and volume and analysis of the milk, were studied. No young were born on the kidney diet. It appears that a more favorable nitrogen balance was obtained on the liver diet than on either the egg or muscle meat diets. Liver, likewise, favored a higher quantity of milk with a greater fat content than either of the other proteins studied. Pups suckling the liver fed dogs grew faster than on the other protein diets. The nutritive importance of manganese has recently

[2] Daggs, C. G., *Jour. Nutrition*, 4:443.

come in for study in both plants and animals. It has been found that diets otherwise adequate but lacking in this element were productive to testicular degeneration in the males. In the females the estrus cycle was not interfered with, but there was a deficient lactation. In the studies of the writer degeneration of the testes has been observed in several instances.

Experimental

Growth. When the producers of commercial dog foods attempt to embody in a single food all of the requirements for growth, maintenance, gestation, lactation and other vital considerations in the life cycle—certainly there can be no fault in choosing growth as one of the major considerations to be expected from such a product. Growth curves, therefore, form the basis of the work here reported. As the basis of the work consisted of carefully controlled feeding tests the most suitable animal is the selectively bred albino or piebald rat. It is considered par excellent for most nutritional experiments. Rats, like man and the dog, are omnivorous in their dietary habits. Their period of growth extends over, approximately, 300 days and their life span is about three years. They live their life cycle at about three to four times the rate of dogs. They multiply rapidly and the large litters which they produce permit of a high degree of experimental control. Because of the large numbers required in a study of this extent, the food, quarters and other factors come in for consideration. Rats adapt themselves very nicely to studies such as these and there is no valid reason why information so obtained should not apply to dogs. We apply information similarly obtained to man and other animals.

Fig. 2. A—Representing growth of rat at 8 weeks of age on foods G. B—Representing growth of rat, on control ration, 8 weeks of age

Chart 2. This represents growth curves. The foods were four commercial dog foods and the control ration. This illustrates the average result on several animals, including both sexes, and extends over a ninety-day period.

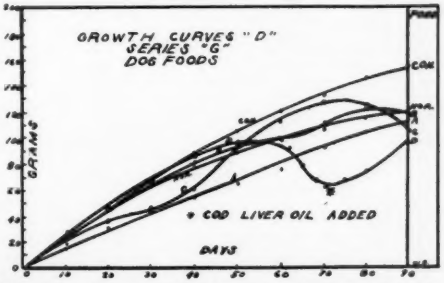

Chart 2. Represents in Curves "D" the character of growth of animals, both sexes, on four dog foods—compared with normal and basic "control" food over a 90 day period of time. Foods C and D are shown deficient in at least vitamine A. Cod liver oil was added to food D at *

Food C shows inadequacy in one or more vital considerations. At the end of a 70-day period the animals commenced to lose weight and develop symptoms of vitamin A deficiency, several dying and others recovering following appropriate addition of vitamin A to the diet.

Chart 3. Representing the percentage of growth, gain in weight, four dog foods shown in Chart 2

Food D did very well so far as growth

is concerned for several weeks, but the animals finally commenced to lose weight and develop characteristic lesions of vitamin A deficiency. Appropriate addition to the diet of cod liver oil straightened the animal out within a few days—note the increase in weight. See Fig. 1 Xerophthalmia.

Foods A and B maintained fairly even

Fig. 3. Two puppies, the larger one had an abundant supply of milk, the smaller one had an abundance of other food but little milk.—Courtesy of the Shattuck Farms, Andover, Massachusetts

growth; both, however, evidenced lack of biological balance at least.

Chart 4. Representing growth of animals at weaning and for a four-week

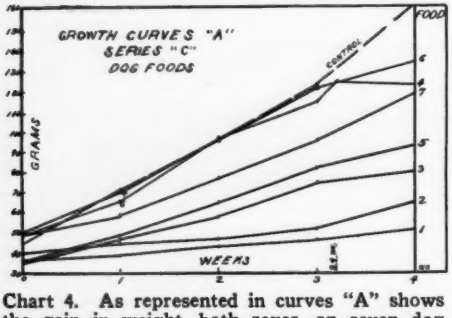

Chart 4. As represented in curves "A" shows the gain in weight, both sexes, on seven dog foods and control ration. Four weeks period of time from weaning

period subsequently. Note the bare maintenance of foods 1 and 2 and the decline after three weeks on food 4. These latter rats were showing characteristic lesions of vitamin deficiency.

Chart 6. Curves E and F. Foods 1 and 2—two foods the growth on which was negligible note the increase in weight when food 1a, vitamin B, was added. It

Fig. 4. The two puppies shown in Fig. 3 four months later, during which time both had an abundance of milk. The one on the right is the one formerly stunted. The earlier lack of material for bone building is evident. Note the narrow chest.—Courtesy of the Shattuck Farms, Andover, Massachusetts

would appear that the stimulation to the appetite and the growth factor of this vitamin assisted materially in this case. The food consumption was increased 50%

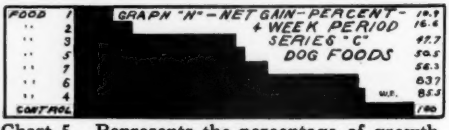

Chart 5. Represents the percentage of growth, gain in weight, seven dog foods as shown in Chart 4

in 1a over food 1. The same procedure—the addition of vitamin B—to half of the animals on food 2 as represented in food 2a failed to produce any increase in growth though there was a slight in-

crease in the food consumption of those getting the vitamin addition. It would appear that the amino acids were inadequate in the case of this food. It is not at all surprising that the addition of vitamin B should make such a difference in one food and accomplish nothing in another. It brings back the old saying, "you cannot make a silk purse out of a sow's ear," and it might be added any more than you can build muscle and vital organs out of proteins inadequate in essential amino acids. It is rather interesting to know that the majority of the foods shown on Chart 4 have a protein chemical analysis the percentage of which varies but slightly; in fact, in five of the seven foods, the percentage varies but slightly over one half of one per cent.

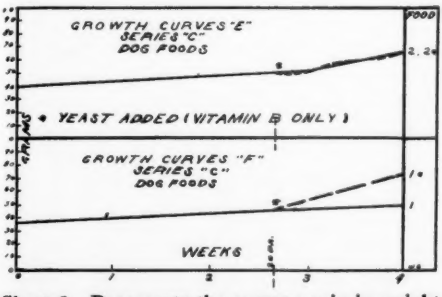

Chart 6. Represents the average gain in weight —foods F and G. Four-week period from weaning. *Foods 1a and 2a are the same with the addition of 2% yeast—vitamine B only. The broken lines indicate the increase in weight when vitamine B was added to the ration

The question arises—how about considerations other than growth? Are dog foods adequate during the reproductive

NEED FOR MINERAL SALTS (Bogert)

As building material for:	Elements needed	Lack of, causes
Bone—teeth	Calcium and phosphorus	Stunted growth, weakened or soft bones, malformed, decaying teeth. Rickets.
Hair—nails—skin	Sulphur	
Soft tissues (chiefly muscle)	All salts, especially potassium, phosphorus, sulphur, chlorine	
Nervous tissue	All salts, especially phosphorus	
Blood	All salts, especially iron, calcium, sodium, phosphorus, chlorine	Lack of iron (and copper) results in anemia
Glandular secretions	Stomach Secretions—chlorine Intestines Secretion—chlorine Thyroid Secretion—iodine	Lack of iodine results in enlargement of the thyroid.

As body regulators to:	Elements especially needed
Maintain normal	All salts
Exchange of body fluids	All salts
Contractility of muscles	All salts, especially balance calcium, sodium, potassium, magnesium
Irritability of nerves	
Clotting of blood	Calcium
Oxidation processes	Iron—iodine
Neutrality of body	Balance between: Basic elements—sodium, potassium, calcium, magnesium and iron Acid elements—phosphorus, sulphur and chlorine.

cycle? Some experiments under way for several months appear to indicate that commercial dog foods are inadequate in this phase of nutrition. The findings in these experiments will be published later.

Discussion

It would appear to some that experiments of this character are too critical. True they are experimental laboratory tests but they give some idea of what we may expect along nutritional lines when any one of several brands of commercial dog foods are fed to animals as their entire source of food. It must not be overlooked that we are told in no uncertain terms that many dog foods are of scientific combination and perfectly balanced. That we can feed it to promote health and vigor and that no other food or additions are necessary. This being the case the food should stand critical laboratory tests as to its adequacy. It is also a critical test for the breeder or the veterinarian who is compelled to keep his charges under close confinement and must rely on the sufficiency of the foods offered for sale. They, too, know that many foods are deficient in promoting health and vigor under such conditions.

Many have learned from experience that they must supplement the commercial food with additions of their own for best results. Veterinarians and breeders realize that disorders of the digestive tract constitute a high percentage of canine ailments. It is not so well-known, however, that errors in diet have an important bearing on organs other than the digestive. Vitamin A deficiency might easily be diagnosed as canine distemper. (See Fig. 1.) There are many practitioners and breeders who will swear by diet in many, more or less, obscure ailments.

It is well to remember that diet has a decided bearing on the physiology of the organism from birth to death. The food we eat, the water we drink, and the air we breath, are vital necessities and we cannot neglect them without paying the penalty of impaired metabolism for our indiscretion. Producers of commercial dog foods will in the future no doubt pay more attention to the adequacy of their product. Many have impressed us with their sincerity. Some have gone so far as to omit "A balanced food" on the labels of their product and in their advertising until such time as it can be said meaningly. Some experimental work has been undertaken in an effort to bring several existing foods to a higher nutritional plane. Others apparently are content with their product. In the final analysis the time is not far distant when more substantial evidence than testimonials will be our gauge as to the merits

SUMMARY OF FUNCTIONS OF VITAMINS

GENERAL	SPECIAL FUNCTIONS OF INDIVIDUAL VITAMINS		
	A	B	C
Promote: General well-being, health of the tissues, appetite, stamina, vigor, endurance and nervous stability, normal functioning of the digestive tract. Nutrition, especially utilization of mineral elements. Resistance to bacterial infections. Growth and reproduction. Prevents deficiency diseases.	Increases restistance to bacterial infections, especially of respiratory tract, eyes, ears, etc. Prevents ophthalmia.	Increases appetite, promotes proper functioning of digestive tract, prevents beri-beri.	Increases resistance to bacterial infections, especially of mucous membranes lining digestive tract. Prevents tooth decay, prevents scurvy.
	D	E	G
	Promotes utilization of calcium and phosphorus. Essential for calcification of bones. Prevents rickets.	Necessary for reproduction. May take part in the utilization of iron.	Promotes nutrition. Prevents pellagra. Prevents black-tongue in dogs and probably some types of "fright disease."

of a dog food. The buying public have hindered the producer of quality products by beating down the price to the most pounds or cans for the least money. It is due for some educational work which can be accomplished with the least effort through the veterinary profession. A quality product can not well be made at a price to compete with those who favor in production the cheapest way out. An adequate food is almost a necessity in this day and age, weaned away, as we are, from feeding table scraps from our own and more diversified diet. The veterinary profession can do much to further a saner understanding as to the nutritional requirements of the dog. There can be no doubt of its action in the matter once all the facts are in its possession.

VITAMIN CONTENT OF FOODS

Rich in vitamins			Poor in vitamins
A	B	C	
Cod liver oil Butter Cream Whole milk Cheese Egg yolk Green vegetables Spinach Lettuce String bean Yellow vegetables Carrots Squash Tomatoes Liver Heart Kidney	Yeast Green vegetables Tomatoes Whole grains Legumes Root vegetables Fruits Milk	Citrus fruit Tomatoes Raw vegetables Cabbage Lettuce Carrot Turnip Cooked vegetables Spinach String beans Carrots Potatoes	Lard Hardened vegetable fats Oleomargarine Olive and other vegetable oils Salt pork and bacon Skim milk powder Sugar and Syrup White Flour (wheat) Corn meal (milled) Rice (polished) Tapioca, Gelatin, Egg white Lean meats and meat extracts
D	E	G	
Cod liver oil Butter Egg yolk Whole milk Green vegetables Liver	Wheat embryo Green leaves Lettuce Spinach Seeds—Corn, peas, oats Fresh meat Egg yolk Whole milk	Yeast Eggs Milk Meat, especially liver Legumes Fruits Vegetables Whole grains	

Conclusions

1. It would appear that commercial dog foods vary greatly in their ability to promote growth.

2. Many foods do little more than provide maintenance in the growing animal.

3. Many of the foods tested were found lacking in essential vitamins, notwithstanding the claim of the manufacturers that these same vitamins were present in the food.

4. There appears to be little justification for the claim of many that the food is a balanced one.

5. It would appear that too much stress is placed on chemical analysis with little or no thought as to biological values.

6. It is not probable that nutrition through the reproductive cycle is adequately provided for in many dog foods.

7. The nutritional requirements of the dog must be given more thought by several producers before their product warrants our consideration.

8. Several dog foods now on the market can be directly charged with causing impaired health when fed according to the directions on the packages.

9. Little or no scientific effort is back of the average dog food.

Bovine Mastitis—Aids for Its Detection*

By MARK STERNFELS, Department of Health, New York City
New York State Veterinary College, Cornell University, Class of 1932

OFTEN it has been said that "a horse is as good as his feet." Paraphrasing this idea, it may not be amiss to say that "a cow is as good as her udder."

Diseases of cows have occurred in periods. The first outstanding disease control work in cattle was done against contagious pleuropneumonia, then against foot and mouth disease and tick fever and lastly tuberculosis. Now comes the present-day activity against abortion. Coming more and more to the fore is the work done in the control of mastitis.

Mastitis (synonyms: garget, lumpy milk, mammitis) is a chronic infection of the udder caused by streptococci or other pyogenic bacteria and characterized anatomically by atrophy and degeneration of the glandular tissue, this being replaced by connective tissue. This is not a specific infection as is tuberculosis, but streptococci are present in such a high percentage of cases that the infection is almost specific. Though the disease is a chronic one there are acute cases, and the chronic cases are characterized by flare-ups or exacerbations. It is a parenchymatous inflammation.

I Forms of Mastitis

1. Catarrhal—confined to the mucous membrane of the teat canal.
2. Parenchymatous — secreting glandular tissue involved.
3. Interstitial—connective tissue of gland involved.
4. Gangrenous—severe infectious gangrene.
5. Specific infection—due to tuberculosis, actinomycosis, and the pyogenes group.

II Portal of Entry of Infection.

1. Through the blood stream (secondary to other infections).
2. Through the skin.
3. Through the teat canal.

III Source of Infection.

1. Infected uterus—following calving, from discharge or from afterbirth.
2. Stable floor.
3. Dirty barnyard.
4. Secondary to foot rot.
5. Following, or along with, cowpox.
6. Milking tubes.
7. Miscellaneous sources.
8. Sources of unknown etiology.

IV Symptoms of the Disease.

1. To begin with, there is a *normal variation* for all healthy udders. Accordingly there is great difficulty in establishing in the mind and in finger tips of the examiner what a *healthy udder* feels like.
2. Abnormal udders vary by slight degrees of fibrosis to severe induration. Accordingly, on palpation udders may be divided into the following classification:
   1. Slight indurations—small area feels more resistant, harder when touched.
   2. Distinct indurations.
      a. Circumscribed—a small definite area is distinctly harder than surrounding normal glandular structure.
      b. Diffuse—A large scattered area is definitely harder than surrounding normal glandular structure.
   3. Marked induration—a very hard portion easily recognized on palpation.

V Diagnosis of the Disease.

Diagnosis of mastitis is by means of clinical symptoms of the animal, the bacteriological findings, the chemical reaction and the physical examination of the milk, as described in the following:

1. *Clinical* examination of the udder by means of palpation reveals the relative degree of induration. To make this examination it is necessary that the cow be milked out thoroughly. Only when

*Acknowledgment is made to Dr. D. W. Baker for his continued help and use of the Diagnostic laboratory at the New York State Veterinary College; and to Dr. D. H. Udall of the Department of Medicine. at the New York State Veterinary College, for suggestions and reference material; and to Dr. S. D. Johnson, for his kind assistance in laboratory and reference material.

the udder is empty can the deeper tissues be palpated satisfactorily. The examination cannot be made satisfactorily on a recently-freshened cow or on one that is about to calve. Proper examination of the udder requires a whole lot of time spent on the milking stool and careful education of the sense of touch in the veterinarians' fingers.

2. *Bacteriological* work done under Dr. D. W. Baker of the Diagnostic Laboratory at the New York State Veterinary College revealed the following facts:

Recognizing the work of Dr. J. M. Rosell of Oka, Quebec, the typical streptococci known as *Streptococcus agalactiae chronicae contagiosae* Nocard-Mollereau gave these results: Using a horse blood-agar medium, at the end of 48-72 hours of growth from milk suspected of mastitis, showed typical alpha prime colonies. (Immediately around the colony is a smaller area of green, surrounded by a slightly larger zone of hemolysis. The whole colony is indistinct, has a fuzzy outline with no solution of erythrocytes.)

Running a direct microscopic test (Breed Method), but using Newman's Stain, as sold by L. F. Nafis, Chicago, Illinois, the following results were obtained: Many samples that showed Alpha Prime colonies on horse blood-agar *did not show long chain streps with Newman stain.* Many samples that showed Alpha Prime colonies on horse blood agar *showed a great many leucocytes with Newman stain. Many samples that showed Alpha Prime colonies showed minute streps with Newman stain.*

Newman stain, as applied to known mastitis milk, when said milk was heavily contaminated (above 100,000 count per cubic centimeter), revealed:

a. Long chain strep;
b. leucocytes;
c. small streps occurring individually.

Using a 6x ocular and an oil immersion lense, our factor was 10,000 times the number of bacteria in 24 fields.

When horse blood agar plates, standard agar plates in 1/100 and 1/1000 dilutions and Newman stain with Breed method were compared on average normal clean milk *below* 100,000 *count* per cc, the results were:

a. That the standard agar gave reliable bacteria counts per cc.
b. That horse blood agar revealed bacterial types present.
c. That Newman stain with Breed Method gave negative results.

Negative results are always disheartening because they do not conclusively disprove anything.

Pertinent to the individual work in this paper, I would summarize by stating:

On Raw Milk

1. That Newman stain with Breed Method (direct count) is a good indicator of types of bacteria present in market milk *if* such types are present at least to the extent of 100,000 bacteria per cubic centimeter.
2. That Newman stain with Breed Method will not detect milk from mastitis cows if such milk has been mixed with average milk, the net result of pooling of these milks resulting in a count less than 100,000 per cubic centimeter.
3. That mastitis milk, free from bacteria but high in leucocyte count, is revealed by Newman stain with Breed Method when such cell count exceeds 500,000 per cubic centimeter.

Newman stain, using Breed Method, did not reveal milk from a mastitis herd. Yet this same milk when run on horse blood-agar revealed typical Alpha Prime colonies. Alpha Prime colonies do not necessarily mean that the milk contains sufficient *Streptococcus agalactiae chronicae contagiosae* from the consumer's point of view or from the Board of Health standards to be considered unfit for consumption.

At Columbus, Ohio, Dr. E. C. Odell, Chief Inspector of the Department of Health, uses Newman stain at Creamery stations as a rough indicator of mastitis infection. When such is found coming from a producer his herd is checked closer by making a thybromol test on each cow. By this gradual tracing down method, Doctor

Odell feels that Columbus has a relatively mastitis-free milk supply.

It is possible to use the Newman stain as an indicator in detecting heavily contaminated mastitis milk. But it is unwise to condemn a milk supply on this sole finding. The technic is useful if follow-up work such as using principally:

1. Strip cup (120 mesh to the inch)
2. Physical examination of individual cows
3. Thybromol test as used by Skar of Oslo, Norway

When attempting to eliminate badly infected cows, it must be remembered that cows can be considered as falling into one of four groups:

a. Normal—The cow is usually normal in every respect. Abnormal findings may be slight and occasional.

b. Suspicious—The udder is repeatedly but not uniformly abnormal with respect to chemical and bacteriological examinations of the milk. There may be a history of an acute attack. Production may be excellent. Physical examination reveals one or more circumscribed indurations and a lack of uniformity in the size and consistency of the quarters. There may be uncertainty as to the significance of the lesions. Repeated examinations are necessary to definitely establish the status of the cow. She may become normal or gradually pass into Group 3.

c. Distinct Mastitis—The udder is distinctly and uniformly abnormal on *physical, chemical,* and *bacteriological* examinations, *but the milk is usually normal in appearance* and *the production may be fair.* Disease is easily recognized by means of a thorough examination and the same lesions are easily and repeatedly found. Often the cow is subject to repeated mild or severe attacks.

d. Marked Mastitis—The udder is so obviously and uniformly diseased with respect to milk, physical condition, and production that the disease is easily recognized at any time, even by an intelligent owner or milker.

3. *Chemical reaction of the milk.* Diagnosis: Rosell says that an increase in chlorine content of the milk is caused by an inflammatory exudation of serum from the blood, and tests for chlorine as follows: To 10cc of the milk add 40cc of distilled water, and 8 to 12 drops of a 10% potassium dichromate solution. From a graduated burette allow an N/10 solution of silver nitrate to drop slowly, mixing with a glass rod until the yellow color of the milk takes the *first* permanent reddish tint. Multiply the number of cc of nitrate solution used by 0.335 to obtain the amount of chlorine in the milk. The normal variation is from 0.09 to 0.14% chlorine.

The pH of the milk can be obtained by using the phenol red test. This is on the same principal as the thybromol test, but gives the pH accurately, instead of approximately.

The advantage of the Thybromol or Bromthymol Blue test is its simplicity. Merely add 1cc of the indicator to 5cc of milk and observe the color—yellowish-green, normal; green, abnormal; dark green, decidedly abnormal. It is important that the indicator be only slightly alkaline or slightly acid. An acid Bromthymol Blue solution is yellow; an alkaline Bromthymol Blue solution is blue. If the solution is too acid it may not give a distinct green in alkaline milk; if it is too alkaline it may impart a green color to normal milk. Thybromol is an acid Bromthymol Blue, and we have observed that the acidity and color reactions vary somewhat in different lots.

The advantage of any of the color indicators is that they reveal the suspect in the stable where she may be given a physicial examination *immediately.* It takes the laboratory to the stable and gives a prompt verdict. While we are not ready to draw final conclusions, the combined examination just mentioned has given uniform results. With few exceptions, the bacteriological and physical examinations have confirmed the readings of the colorimetric tests. Cows with a history of mastitis and still carrying circumscribed indurations in the udder are usually revealed. The percentage of herd

infection is quickly determined, and nonreacting cows may be bought with reasonable assurance that their udders are healthy. This information is essential to the control of a disease so widespread, insidious, and incurable as inflammation of the udder, commonly known as "garget."

4. *Physical examination of the milk*: The physical condition of the milk varies from pinpoint flecks on the strip cup—120 mesh to the square inch—to large clots or even strings of milk. Often the physical character of the milk, if not serious, can be altered by lowering the protein content of the ration bringing it down to below 16%.

VI Treatment:

In 1876 Doctor Law stated that the following treatment for the animal gave fair results. Today, the fundamental precepts are essentially unchanged:

1. Give laxative.
2. Diuretic.
3. Hot applications at beginning of trouble.
4. Cold applications in later stages to udder.
5. Suspensory bandage.
6. Frequent milking.
7. Use of antiseptics.
   a. Eliminated through milk when given per os: formalin, methylene blue, turpentine.
   b. Antiseptics in teat canal, acriflavine, reddu (pyridium).
   c. Applied to surface of udder.
      Iodex or—
      ℥ ii spirits of camphor
      ℥ ii turpentine
      ℥ ss oil of wintergreen
      ℥ ss carbolic acid
      lb. ii heated vaseline
8. Biologics
   a. autogenous bacterins
   b. feeding animal some of her own milk
   c. Yatren bacterin (casein)
      (good as prophylactic agents; questionable as to worth when disease is already present.)

VII Control

1. Dispose of bad cases
2. Segregate affected animals
3. Milk affected animals last
4. Watch for occurrence of new cases and isolate early
5. Milk clean and dry
6. Dip teats in mild antiseptic solution after milking
7. Wipe udder with clean coth before milking
8. Use clean equipment
9. Dispose of infected milk properly
10. Keep a herd history and individual record.

Conclusion:

1. Mastitis is important to the *producer* because it materially injures the health of the cow and lowers her producing capacity.
2. Mastitis is important to the consumer of milk because such a product is a constant menace to the milk using public.
3. The time is not far off when each municipality through its agents of milk inspectors and veterinarians will recognize the importance of mastitis. We turn to these men to help reduce and control the spread of the disease more by educational than by punitive enforcement.

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Alcohol	486.0
(Eastman Kodak) Tetrachloroethane	360.0
Glacial acetic acid	54.0

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Acids in Relation to Occupational Diseases

By MARK W. ALLAM, Philadelphia, Pennsylvania
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THE article in the January 1, 1932 issue of VETERINARY MEDICINE on Formic Acid as Treatment in Respiratory Diseases, by G. H. Gunert, stating in part: It has been generally noticed that laborers employed in factories in which they had been continually exposed to the inhalations of acid-fumes such as hydrochloric in wool and cotton factories, fluoric acid in glass factories, sulphuric acid in cellulose factories, formic acid in linoleum factories, acetic acid in vinegar factories, etc., seemed to possess an extraordinary resistance toward, if not even a certain degree of, immunity to diseases of respiratory organs and usually lived to an old age in excellent health—deals with a problem which has received considerable investigation and study, as it deals with the welfare of the factory worker, miner, etc.

The discussion of this subject would fill a volume and touch on practically every point of medical science, if one were to go into it in detail.

This brief resumé on the discussion tends to deal more on the practical findings of some of our scientists and the value of the different poison vapors as inhaled by the factory worker, miner, etc.

According to some of the most prominent workers in the field of occupational diseases, it has been shown that the constant inhalation of a small amount of acid over a long period of time or of a more concentrated amount over a short period of time causes detrimental effects to the body in general and particularly the respiratory system.

Professor Charles Baskerville in the American Labor Legislation Review, Vol. ii, 2, June, 1912, gives the following comprehensive summary of these poisons:

"The usual gases which give rise to complaint in manufacturing localities are the following: chlorine, which is emitted by pottery kilns, hydrogen chloride, which is produced by the combustion of coal and by pottery kilns, nickel and cobalt smelting, platinum refining, glass manufactories (fluoric acid, hydrofluoric acid), sulphur dioxide and sulphuric acid which result from the combustion of coal, coke, petroleum, etc., fluorides and hydrofluoric acid which are emitted from acid phosphates and heavy chemical plants, organic vapors from, for example, glue factories, bone burners, slaughter and packing houses, and phosphoric fumes from match factories.

"Of the gases which affect the respiratory passages and eyes, the most important are illuminating gas, carbon monoxide, carbon dioxide, chromic acid, chlorine, sulphuric acid, hydrochloric acid, nitric acid, mercury cyanide, ammonia, naphtha, benzene, sulphur, hydrogen sulphide, sulphur chloride, nitrous gases, hydrocyannic acid."

Some of the vapors from organic compounds and substances such as tar, creosote, carbolic acid, petroleum, methyl alcohol, nitroglycerin, formaldehyde, formic acid, pyridin, etc., also cause acute and chronic respiratory and eye affections.

According to the works of George M. Kober, Washington, D. C., and William C. Hanson, Belmont, Mass., on occupational diseases, acids as commonly inhaled by factory workers have no known value as far as immunity or resistance to respiratory diseases is concerned and instead cause acute and chronic affections of the body in general.

As translated by William H. Rand, M.D., the following is a brief summary of a few of the more important poisons and some of the conditions produced by them.

1. *Hydrofluoric acid,* as produced in glass factories, etc., causes intense irritation of the eyelids and conjunctiva, coryza, bron-

chial catarrh with spasmodic cough and ulceration of nostrils, gums and oral mucous membrane.

2. *Sulphuric acid,* in cellulose factories, causes inflammatory diseases of respiratory organs, as acute and chronic catarrh, anorexia, decalcification of bones, injury to teeth and softening of dentine.

3. *Turpentine oil,* in manufacture of varnishes, cement, etc., produces irritation of the mucous membranes of eyes, nose, (coryza) and upper air passages, salivation. Prolonged action causes irritation of kidneys.

4. *Hydrochloric acid,* as produced in potteries, glass factories, etc. A proportion of 0.05cc per 1000cc of hydrochloric acid can be borne only a short time. A greater concentration as well as often repeated inhalations, even of moderate quantities, in manufacturing industries causes chronic irritation of mucous membranes to which the vapor has access, also catarrh of conjunctiva, coryza, pharyngeal, laryngeal and bronchial catarrh, dental caries.

Concentrated hydrochloric acid vapors cause death.

5. *Formic acid.* This acid is liberated in the manufacture of linoleum, and might at first be considered as being of some value as an immunity producing vapor in respiratory diseases but the inhalation of vapors from even a diluted solution causes severe irritation of respiratory mucous membranes, catarrh, and smarting of the eyes. Long continued inhalations period may cause bronchitis, pneumonia and conjunctivitis.

The addition of glacial acetic acid to formic acid in attempting to acidify the air in treating respiratory diseases would, according to reports, aggravate the condition to such an extent as to cause severe disturbances in the respiratory tract.

The effect in general of the inhalation of mineral acid fumes by man varies, naturally, with the duration and density of the fumes. Concentrated fumes may cause death while less concentrated will cause cough, increased bronchial secretion, turgescense of veins, lowering of blood pressure and coagulation time of blood is lengthened.

OSTEOMALACIA OR RICKETS

About 1800 head of grade, hereford heifers and steers were in feed lots for about six months. The ration consisted of kaffir corn and one pound per steer per day of cotton seed cake. About four months after being placed in feed lots, the usual eye disorder and some locomotor disturbance was noticed in several head and the cotton cake was withheld.

About this time several head went down and were unable to get up. Some of those that were down were treated with calcium gluconate and apparently recovered. All remaining cattle in feed lot were given bone meal, one ounce per head daily in their feed for ten days and then one-half ounce per head daily. There had been an occasional case of keratitis even prior to the time that locomotor disturbances became evident. There was about 50 head that was apparently blind before adding bone meal to the feed and within two weeks there was over 80 head that were blind.

There was little or no congestion in the affected eyes although there may have been congestion in the early stages as a caretaker had noted that there was redness of the eyes prior to the time that the animals lost their vision. The cornea evidenced a scum or deposit which may have been of inflammatory origin or it may have been due to desquamation of the corneal epithelium (keratomalacia).

Was this eye disorder a sequel of infectious keratitis? Or, was it due to dietary deficiency? If due to a deficiency, what vitamine or chemical ingredient was wanting? And, what addition to the diet would prevent a recurrence and relieve the present condition?

It will be recalled that the blindness and paralysis that supervenes at about the hundredth day of feeding on cotton seed meal and progresses rapidly in the herd if the cotton seed feeding be continued, is checked immediately the cotton seed in the ration is discontinued. Thus this herd differed from ordinary "cotton seed poisoning."

Cecal Impaction in the Horse: Recovery

By PAUL GRANHOLM, Ames, Iowa
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OF THE large number of medical and surgical cases treated during the year 1931-32 at the Iowa State College veterinary clinic, twenty-three were cases dealing with intestinal impaction in horses. One case of particular interest was an impaction of the cecum. The patient, an eight-year-old, black gelding, was in good flesh, and fair general condition.

History

October 15, 1931, our ambulatory clinic, which is the mobile portion of our regular veterinary clinic, answered a rural call to see a "colicky horse." Upon arrival, and prying into the mysteries of the case, we were told by our client that four days prior to this time the horse had first evidenced a rather moderate type of colic accompanied by a slight degree of restlessness. Defecation was at this time retarded, and two to three days later ceased altogether. The appetite had dwindled markedly during this period. The owner, being somewhat of a "veterinary minded" individual, had given Epsom salts *ad libitum*, but without avail.

With this history the patient was presented for diagnosis and treatment.

Symptoms

A physical examination of the patient revealed a complete suppression of peristalsis in the large intestine. General symptoms were absent, the pulse, respirations and temperature being but little affected.

In view of the history and our observations thus far, it was quite apparent that we were dealing with some form of impaction. Incidentally, rectal palpation was resorted to in an effort to locate and determine the position and character of the impacted mass. A greatly distended cecum was found in the upper portion of the right flank region. The greater curvature of the organ was smooth, and projected posteriorly almost to the pelvic inlet. So great was the degree of distention that the sacculations normally found in the cecum were entirely abolished, and the organ was smooth and tense.

Diagnosis

A diagnosis of cecal impaction was made from:

1. A history of a rather mild type of colic and great chronicity with recidivations restlessness at long intervals.
2. A retardation of defecation, which later gave way to constipation, and was followed by a complete suppression of peristalsis of the large intestine.
3. An apparent failure of all former attempts at purgation.
4. An absence of any general symptoms, such as alterations in pulse, respirations, and temperature.

The diagnosis was further substantiated and confirmed by the discovery on rectal examination of the greatly distended cecum, filled with a semi-solid, yielding, mass of ingesta.

Treatment

The treatment, which was outlined, consisted of the initial administration of one gallon of oil (given through a stomach tube) and repeated at twelve-hour intervals until three gallon had been administered. This was supplemented by the administration subcutaneously at four-hour intervals of ½ grain of arecoline hydrobromide and ¼ grain of strychnine sulphate. Due to the inconvenience in carrying out such a procedure on the farm, the animal was later transferred to our veterinary clinic, which facilitated greatly the matter of routine treatment.

While at the clinic, in addition to the arecoline and strychnine given at regular intervals, the animal was given the following mixture daily, by way of the stomach tube:

Calcium chloride	Grams 200
Sodium bicarbonate	Grams 300
Sodium chloride	Grams 100
Water (warm)	q. s. Gallons II

The results from this treatment were most encouraging. Three days after the initiation of the treatment, peristalsis was beginning to reappear in the hitherto inert cecum. On the fifth day feces were passed, and on the sixth day the horse was again eating. After being in the hospital exactly one week, the animal was dismissed, having made an apparent uneventful recovery. This case therefore run a course of 13 days which is about three days less than the average course of fatal cases of cecal impaction in the horse.

Discussion

Impaction of the intestines is perhaps the principal and most frequent cause of true gastro-intestinal disturbances in horses. Cecal impaction, while not frequent is far from being uncommon in occurrence, and may be encountered at any time in one's practice, and constitutes a baffling problem, both as regards successful treatment and prognosis. Hutyra and Marek state that from 10% to 18% of the deaths occurring in horses from intestinal impaction at the Berlin and Budapest veterinary schools are caused by impaction of the cecum.

Impaction of the cecum is of further interest because it is only within recent years that it has been recognized and successfully treated. H. Caulton Reeks, in his excellent work, "The Common Colics of the Horse," states: "The first definite description of this condition was recorded in 1908 by D. M. Campbell, under the heading, 'A Case of Cecal Impaction of More Than Two Weeks Standing,' which prolonged course we know now to be typical of the condition." Further, in a most interesting article in a British veterinary periodical, Mr. Reeks, F. R. C. V. S., stated that it is one of the most remarkable coincidences in the history of veterinary medicine that in the English veterinary literature of a period of more than 100 years which he examined, there should be no mention of this condition as such, nor any indication that it was ever correctly diagnosed. Obviously, many cases occurred throughout this period and presumably all affected animals died. The diagnosis of the condition is unmistakeable on postmortem examination and it is strange indeed that throughout this period, no autopsies were held on such cases, or if held, were recorded.

Etiology.—The causes of intestinal impaction fall classically into two main groups, viz.,

1. Predisposing causes.
2. Exciting causes.

Of the predisposing causes of cecal impaction, the anatomical structure and position of that organ are undoubtedly the most important. The relatively large cecum with both of its openings at the dorsal end are perhaps contributing factors which may under certain conditions cause an interference in the passage of ingesta. Since the cecum normally contains a large amount of liquid and in cecal impaction its contents are semi-solid or even solid and in extreme cases dry, it is reasoned that an insufficient amount of drinking water over a considerable period may be a predisposing factor.

The exciting causes of cecal impaction are found chiefly in the type of food, as well as the manner in which it is fed. Rough, coarse, woody food, containing a large amount of cellulose is difficult for the digestive tract to handle, particularly when it is given in too large quantities.

Differential Diagnosis.—From a standpoint of differential diagnosis, impaction of the cecum must be differentiated from impaction of the small intestine and the colon.

The accumulation of ingesta within the large intestine, due to its greater volume, occurs more slowly than that within the small intestine, thus the degree of desiccation is much greater. Following this stasis and subsequent drying, the contractility of the muscularis of the large intestine gradually diminishes, and with the slower accumulation of ingesta, there are progressively weakened convulsive contractions with only a moderate type of abdominal pain exhibited. On the other hand, the accumulation of ingesta within the small intestine is very rapid. Immediately the impacted portion of the bowel, and that anterior to it, is stimulated to pronounced convulsive contractions, resulting in rather marked, inconstant, abdominal pain. In addition, alterations in general symptoms are seen early in an im-

paction of the small intestine, particularly the accelerated pulse. In impaction of the colon all symptoms are intensified over those of cecal impaction and the duration of the attack is of course much less.

Prognosis.—The prognosis in cecal impaction is always problematical. In early cases under proper treatment the prognosis may be considered fairly good as far as that particular case is concerned. Unfortunately, however, an initial attack is too often followed by others, which tend to become progressively severe, to occur at shorter and shorter intervals, perhaps ultimately leading to a rupture of the cecum and death. Following a few mild attacks, pathological changes occur within the wall of the cecum, and it becomes thickened, loses its normal tonicity, and dilates, thereby predisposing to severer and more frequent attacks.

Prevention.—Following an initial attack of cecal impaction, special attention should be given to the type of food given as well as the manner in which it is fed. By withholding coarse, woody material, containing a great deal of cellulose, and feeding sparingly of light, nutritious, easily digestible foods, future attacks of intermittent colic may perhaps be avoided.

USE OF THE EMASCULATOME RESULTS IN "SLIPS"

One of my clients shipped in 50 head of high-grade Hereford calves from another state, for feeding. Six months later, it was noticed that some of the supposedly steer calves seemed to be bulls. Upon inquiry, it was found that the calves had been worked on at the point of shipment by a layman using an emasculatome. Out of the 50 head it was necessary to recastrate 35 head.

In operating, it was found that in most cases, a part or all of one testicle was left and was functioning. This condition had a serious effect on the cattle as feeders, In my opinion, the emasculatome is not a reliable instrument in the hands of a layman. In fact, its use in the hands of an expert is doubtful in my opinion.

Princeton, Illinois. T. P. Taylor.

ECTOPIC TESTES IN A BULL

A six-months-old Shorthorn bull was brought to the hospital for a cryptorchid operation. His owner had supposed him to be a steer until a short time previously when he began to show masculine characteristics. It was learned that an attempt had been made to emasculate him with an emasculatome when he was a few days old. There was no scrotum at that time, and when the animal was presented at the hospital the scrotal area was just slightly convex with a couple of wrinkles on it. There were two transverse scars on the right side of this area indicating that the castrator was able to find only one testicle.

Upon palpation anterior to the scrotal region, a movable, firm mass of tissue of about the size of a hen's egg was found on the left side. This resembled testicular tissue to the touch. A smaller firm mass was found on the opposite side.

The animal was cast on the mats and securely tied with ropes. The scrotal area and the region anterior to it were cleaned, shaved, and painted with tincture of iodine. An incision was made on the right side over the small nodule to expose it for examination. It proved to be an atrophied testicle and epididymus surrounded with fat and connective tissue and covered with a tunic. There was a constriction on the spermatic cord so it was concluded that the emasculatome had crushed the cord in the earlier attempt at emasculation.

A similar incision was made on the left side and a testicle was exposed in the region just anterior to the external ring of the inguinal canal. This testicle was removed by clamping the cord with hemostats because the emasculator could not be introduced into the canal. Scissors were used to sever the cord.

Nearly a year ago a similar case was brought to the hospital with one ectopic testicle which was removed from the region on the ventral abdominal wall anterior to the external ring of the canal. The history of this case revealed that a

laporotomy investigation a few months previous resulted in failure to find the hidden testicle.

Upon investigation it was found that these two animals were full brothers; another of many evidences that cryptorchidy is heritable.

Ectopic testicles are relatively common in the bovine, and may be found in many locations, sometimes at a considerable distance from the scrotum. Before operating on a bull for abdominal cryptorchidism, a careful search should be made for ectopic testicles. This will obviate making the mistake of searching the abdominal cavity for an undescended testicle, when the case is really one of ectopic testicle.

Harold E. Wicher,
Ames, Iowa. I. S. C. '32.

ABSCESS IN A STALLION

A BAY Belgian stallion was entered in the veterinary clinic at Iowa State College, February 2, 1931. The horse was in good physical condition and in good flesh.

History: the stallion had become injured on the ventral abdominal wall, while on the breeding circuit, during the preceding spring. This injury had led to quite a large swelling. The owner revealed that numerous times a veterinarian had been called and that at each time the swelling had been incised so as to give it liberal drainage. This had caused the swelling to disappear to a great extent each time. However, as soon as the incisions healed sufficiently to prevent the discharge of pus, the swelling recurred.

At the time of entrance into the clinic there was a circumscribed swelling about six inches in diameter, located on the ventral abdominal wall, about fourteen inches anterior to the umbilicus and about nine inches posterior to the xiphoid cartilage. In the center of this swelling, on the linea alba, was a small opening that was discharging thick, yellow pus.

The condition was diagnosed as an abscess. The animal was confined on the operating table. Then the area around the wound was clipped, shaved and painted with tincture of iodine. A probe was inserted into the opening in the abscess a distance of about four inches. The wall of the abscess was very thick, indicating a chronic irritation. An incision about three inches long was made and the abscess was then probed and explored by the use of a finger. It was found that the tract narrowed down and that at the bottom a foreign object, lying in an antero-posterior direction, could be palpated. This object was approximaetly five inches from the wound incision. Following this discovery, a forcep was inserted and the object was grasped and removed. It proved to be a piece of smooth wire about three and one-half inches in length.

The wound was packed with bipp-gauze which was sutured in place. This pack was removed seven days following the operation. The stallion was cross tied the first ten days following the operation to prevent him from lying down. The wound was practically healed in ten days' time and the swelling had decreased considerably. The horse was sent home. There was no recurrence of the abscess.

It is a well known fact that every pathological condition is due to some etiological factor; yet, abscesses are of such a common occurrence that they are barely considered in this manner, especially so when treatment is administered. It is true that many abscesses in muscle tissue are due to bruises and injuries and that they will readily respond to the routine treatment of opening to give drainage; however, many of the abscesses in muscle tissue are not caused by these factors, but by some foreign body. This type of abscess will not respond to such simple routine treatment. It is necessary to examine the abscess to locate and remove the cause, which entails a thorough examination of the abscess. Hence, we can refer back to the old teaching, "Remove the cause and the condition will generally take care of itself."

Ben E. Shoneman,
Ames, Iowa. I. S. C. '32.

Removal of a Teat Tumor by Stripping from Mucous Membrane

By GEORGE E. BUEHLER, Ames, Iowa
Veterinary Division, Iowa State College, Class of 1932

A HOLSTEIN cow, four years old, and in poor condition was presented at the Iowa State College veterinary clinic with the following history:

The cow had calved three days previously. At time of calving the udder exhibited considerable lymphatic edema and owner experienced difficulty in getting milk from right front teat. He could get a stream or two and then the flow would cease.

The cow showed the following symptoms: Pulse 62, respiration 24, temperature 102.4° F, right front quarter slightly distended. A small amount of milk could be expressed and after that no more could be obtained for several minutes, after which another small stream could be expressed. On palpation a tumor-like mass of about the size of a large bean, could be felt in the teat canal, at the junction of the teat with the udder. This tumor-like mass was slightly movable and acted as a ball valve, preventing milk coming from the udder into the teat. After emptying the teat the mass would migrate slightly upward, allowing a small amount of milk to again enter the canal.

Treatment.—The cow was restrained in lateral decumbency with the infected quarter uppermost. The infected quarter and teat was washed thoroughly with soap and water, and dried. A cloth saturated with a 1-1000 solution of bichoride of mercury was placed over the udder with the infected teat passing through a hole in the cloth. The teat was sponged with tincture of iodine and all the instruments used were sterilized by boiling for twenty minutes.

Moore's cone shaped dilator was inserted into the teat orifice, dilating the sphincter till the orifice was about one-fourth inch in diameter. Alligator forceps were inserted into the teat canal and the tumor grasped. An attempt was now made to cut the tumor lose by means of a round pointed teat bistoury. However, owing to the tough fibrous nature of the tumor, great difficulty was experienced. The alligator forceps and knife were then removed, and a small pair of rat tooth hemostats was then introduced, grasping the tumor with point of forceps; the forceps were then rotated and pulled downward, tearing loose a small portion of the tumor. This process was repeated until most of the tumor was removed. Considerable hemorrhage occurred but not as much as usually follows removal of these tumors with a bistoury. After this the milk flowed freely down into the teat and no difficulty was experienced in milking out the quarter. After again painting the teat with tincture of iodine the cow was released and returned to her stall.

After-care.—The cow was milked at frequent intervals to remove blood clots and to prevent closure of wounded area. The next morning following the operation a small blood clot was removed by stripping. A close watch was kept for any evidence of infection in the quarter, but none appeared. After three days the cow was discharged from the clinic apparently all right.

Results.—Three days later the cow was returned to the clinic. The lower two-thirds of the teat was hard, swollen and painful. However, the teat surrounding the operative area was not involved in this second swelling, indicating that infection had entered at some other area. The owner stated that he had placed a calf upon the cow to nurse this teat. On the second day after taking the cow home, the swelling appeared.

Treatment.—Teat was now soaked in a 2% therapogen solution at a temperature

of 120° F. for one-half hour. At the end of this time by careful manipulation the teat could be milked. The first milk obtained was somewhat thick and stringy while the last was almost normal but somewhat watery. The teat was soaked in the above manner several times that day and the quarter milked each time.

The next day the skin on the lower one-half of the teat began to necrose. The frequent soakings were kept up with the application of 5% phenol in cottonseed oil after each soaking. The next day the teat was much better and this treatment was continued; after two more days the condition was much improved. The swelling was almost gone and the external surface of the teat began to heal. When the case was last seen it was well on its way to a complete recovery. At no time during the last stay in the clinic, did the original lesion at the base of the teat give any trouble; the milk passed through it freely at all times.

Discussion.—The first condition of this cow is a slight variation of one that is frequently encountered. Obstruction at the base of the teat may be congenital but more often is due to a chronic catarrhal mastitis. This results in the proliferation of connective tissue and sometimes of adhesions in the mucous membrane at the bottom of the galactophorus sinus. This particular process resulted in a tumor-like mass which impeded but did not completely obstruct the flow of milk into the teat—it acted somewhat like a ball valve which was forced into the teat canal by the act of milking, thus shutting off the flow of the milk.

Removal of these obstructions is frequently unsatisfactory as they tend to recur, making a permanent cure difficult to obtain.

In this particular case the original condition was apparently handled successfully. The cause of the second trouble is not clear. There is a possibility that placing the calf on the cow was a factor; also, no one knows what the owner may have practiced in the way of home treatment. The interesting feature is that apparently the original lesion was not involved in this second inflammatory process.

RUPTURE OF UTERUS IN COW FROM FETAL DYSTOCIA

On April 13, I was called to relieve a heifer that had undoubtedly been laboring for more than twelve hours, with a posterior and hock presentation. The fetus was dead. I proceeded to cord the hind legs and correct their positions by having an assistant pull on the cord while I had the hoof of the fetus in the palm of my hand so as to safeguard the uterus.

With a little repelling with the other hand, the posterior limbs were easily and quickly corrected and the fetus easily removed. At no time in my presence, did this heifer strain much. When the fetus had been removed the fetal membranes were coming loose and with just a very little traction they came away entire. I then examined and was very much surprised to find the whole upper half of the uterus completely severed from its posterior attachments, so that the severed ends would be fully twelve inches apart and the organ would sink way down into the abdomen.

I told the owner I felt she did not have much chance to live since the uterus had no external drainage. Even though I felt she had no chance to recover, still I felt like giving her the benefit of the doubt and doing all that could be done.

I procured some stout cotton cord the kind that often comes round packages sent through the mail. First these were well sterilized by boiling. The cords were two feet or more long. With a large needle threaded with this cord, I entered the uterus with my right hand and stitched through both edges. It was a man-sized job you may be sure. Then I drew the needle and tied a knot, then worked this knot into the place where both edges of the uterus were approximated. I kept making stitches approximating the edges and tying knots as described until it was all approximated. This heifer never missed a meal and is doing fine. The condition of the uterus before it was sutured would have made it impossible for the heifer to live.

West Point, Iowa. S. P. Holtz.

Adeno-Sarcoma in a Dog

By EUGENE PECK, Ames, Iowa
Veterinary Division, Iowa State College, Class of 1932

A FEMALE fox terrier; nine years old; weighing about 25 pounds, entered the Iowa State College veterinary hospital, January 11, 1932. She was white with yellow and black markings. The owner first noted a swelling near the left jaw four weeks previously. The swelling, which was accompanied by a severe cough, gradually enlarged and extended down the neck. Her appetite was very irregular; she choked easily and was very thirsty. The left eye showed lack of reflex control.

It was thought to be a tumor, but no efforts were made to treat the condition until a definite diagnosis was made. The enlargement was punctured and a liquid of a dark sanguinous nature was obtained for bacteriological examination. The results were negative so a biopsy was performed under local anesthetia, two sections being removed. One section was so fragile that it broke up during preparation; the other revealed a tumor of a malignant type not definitely determined at the time.

The dog was destroyed by chloroform January 16. Necropsy followed immediately.

The dog was very fat. Rigor mortis had not started as yet. The nasal openings were partially filled with a dry, hard mucus. The visible mucous membranes were very pale, showing an absence of blood in the peripheral circulation. A slight yellowish tinge could also be noticed in the membranes.

The left cervical region was much enlarged. There was a firm, hard swelling, irregular in outline with a rather definite line of demarcation extending from the base of the ear, partially around the throat and to the anterior border of the parotid salivary gland. A second large swelling was discernible in the prescapular region; in size about three inches by two inches. Two other small swellings could be palpated on the opposite side, in the same region. The entire underline of the neck was greatly swollen and enlarged. The skin over this area was cold.

No visible lesions were present in the oral cavity. The salivary glands were somewhat encroached upon by the swelling and tissue invasion.

The entire cervical region was a mass of cells, some normal, but many that were pathologic. Some of the masses contained much adipose tissue while others were more epithelial in nature. All were a dark reddish-brown color. Some of the masses were firm and could not be broken down easily while other masses were very fragile.

The interior of the esophagus was normal apparently, but externally the tumor had caused constrictions at various points.

The abdomen was much enlarged and flabby; as the animal was very fat. The intermuscular spaces were filled with a yellowish tinged fat.

The stomach contained a small quantity of regurgitated bile. About two inches of the mucosa near the pylorus was infiltrated with blood.

The small intestine contained only a small amount of bile. The walls were somewhat thickened due to age. Two small hemorrhagic areas about one-half inch in diameter were present on the mesentery and the external surface of the intestine. The areas were small nodules surrounded by a reddened area filled with blood. The nodules were soft when incised, containing a small amount of extremely dark red blood which had not clotted.

The cecum was small and knob-like, surrounded by much fat.

The liver was a bronze color with an

adherent capsule. The whole body showed the effects of a hematogenous icterus.

The omentum and mesentery contained much fat. There was a slight adhesion between the omentum and intestine.

The larynx was somewhat reddened and constricted by pressure from the tumors.

The pleura appeared to be normal. The lungs were a gray-white with a great many small black specks, giving them a salt and pepper appearance. There were also many small nodules of a reddish blue color visible just beneath the pleura. These areas varied in size from $\frac{1}{16}$-inch to ½-inch in diameter. Upon incision a soft red tissue was present. This tissue was very friable and infiltrated with small quantities of unclotted blood which was dark red. Surrounding each nodule was a small reddened area.

The heart was very flabby, had collapsed, and showed some degenerative changes. No lesions were noted on the pericardium. In the left ventricle there was a small translucent nodule ($\frac{3}{16}$ of an inch in diameter). It was embedded in the muscle of the heart just beneath the endocardium.

The blood was of a very dark red color, viscous and remained uncoagulated in the vessels. Part of the body showed evidence of an insufficient supply.

All of the lymph nodes of the neck and anterior thoracic region showed marked involvement; much enlarged, soft, fragile, dark red in color, and occasionally filled with fatty tissue. Their appearance showed evidences of rapid growth without proper nourishment. The center of each node contained a small amount of blood. There were some evidences that the tumor cells had followed lymph channels as well as blood vessels to the heart.

The spleen was perhaps slightly enlarged, very rough and granular in appearance. The capsule was firmly attached. Two small nodules were present on the spleen resembling those on the lungs.

The bladder was somewhat thickened and there was some connective tissue increase in the kidney.

The thyroid gland was not distinguishable at the autopsy but prepared sections revealed its presence. It was perhaps the initial seat of disturbance.

Pathologic Anatomic Summary

1. Dry, hard nasal plug.
2. Peripheral anemia, also generalized.
3. Hematogenous icterus.
4. Pressure (degeneration or atrophy) of the carotid salivary glands.
5. Partial constriction of the esophagus.
6. Mild hemorrhagic gastritis, also enteritis.
7. Atrophy and fatty degeneration of cecum.
8. Adhesion between omentum and intestine.
9. Constriction by external pressure and tissue proliferation of the larynx and trachea.
10. Anthracosis, anemia and metastic tumors of the lung.
11. Degeneration of the heart with a metastatic tumor.
12. Lymphatic metasteses, with necrosis and fat infiltration.
13. Splenic metastisis.
14. Chronic cystitis and nephritis.
15. Disturbance of optic reflexes.
16. Thyroid tumors.

This condition was diagnosed as an adeno-carcinoma of the thyroid gland with metasteses to the lung, heart, spleen, intestine and anterior lymphatic system.

Upon examination of the seven prepared sections it was possible to see how the tumor cells had escaped from the region into the blood and lymph vessels.

The lesions observed in this case follow those described by Ewing in his text. Colloidal secretions could be observed in the lung tissue along with the epithelial cells of the tumor. Cell division was taking place very actively in many of the nodules. This tumor was evidently of a true carcinomatous type but may have originally been a thyroid involvement. Its sudden development was remarkable.

Amputation of Teat in a Cow

By EMERY ENGE, Ames, Iowa
Veterinary Division, Iowa State College, Class of 1932

THE patient was a roan, three-year-old, grade Shorthorn. She weighed 900 pounds and was in fair condition. Her butterfat record was equal to that of the average three-year-old cow of that breed.

The owner said the right front teat had been enlarged and difficult to milk for one week. We asked him if he had been using the milk tube and he said, "No." Then we asked him how he milked the quarter. While describing his method he stated that he had difficulty in introducing a tube and towards the last he could not insert it. Due to the farmer's lack of asepsis the milk tube served as an effective means of introducing infection.

The teat was three times the size of the opposite one and much inflamed; the lumen closed, thus completely obstructing the flow of milk. A slight inflammation had developed at the base of the quarter.

The teat instruments were put in the sterilizer and boiled for twenty minutes. The cow was put on the operating table. The teat was cleaned, dried, and painted with tincture of iodine. A piece of muslin with an opening made for the diseased teat was soaked in a 2% therapogen solution for fifteen minutes and then placed over the udder and right hind leg of the animal. The muslin was held in place by means of a pair of forceps hooked to the cloth and the hair.

The operative area was again painted with tincture of iodine. A probe was inserted into the teat canal. But no discharge was obtained from this. A teat dilator was then inserted into the teat orifice. After the sphincter had been dilated sufficiently it was incised with a teat bistoury.

For an hour after the operation the teat was soaked in a warm 2% therapogen solution. This seemed to soften the teat and for a while we thought it might be saved. The cow was put away for the day and the caretaker instructed to milk out the affected quarter every two hours until the next clinic period.

Upon examination the next day it was found that the distal one-half of the teat had started to necrose. The instruments necessary for amputation of the teat were put in a sterilizer and boiled for twenty minutes. The cow was put on the operating table and an area three inches in height surrounding the base of the quarter was shaved, cleaned, dried and painted with tincture of iodine. A piece of muslin soaked in a 2% solution of therapogen for twenty minutes was put over the udder and rear leg. The area was again painted with tincture of iodine. An area an inch above the base of the teat was infiltrated around the entire quarter with a 2% solution of apothesine. The first time around the skin was infiltrated and the next time the deeper tissues.

Since the blood supply is the greatest on the anterior-lateral side, the initial incision was made on the lateral side; then working towards the anterior medial and posterior sides, and the teat thus removed.

Due to the marked swelling at the base of the teat, suturing offered considerable difficulty. The sutures were put in from inside to outside. The needle was taken from the suture on the outside and threaded on the inside and drawn to the outside, the sutures drawn up tight and tied, suturing the mucous membrane to the skin. Since hemorrhage is very great in this area an incision one-half inch in length was made at a time and then sutured, being careful to place the sutures close together.

When the operation was finished there was a continuous row of interrupted sutures around the opening of the quarter. The area surrounding the udder was disinfected with 2% therapogen solution and the cow taken to the stall.

The drainage being nearly perfect the chance of fluids accumulating in the quarter was slight. Immediately after the operation the quarter was gently milked and a large amount of flaky cheese-like milk removed. The wound was kept open for two days after the operation by means of a sterilized forceps inserted into it three times a day and spread open. After two days the swelling was completely gone, and the quarter was getting along nicely. Two weeks later the wound had healed and the cow made an uneventful recovery.

The need of careful teat surgery is great. In this type of surgery asepsis cannot be stressed too much. If one becomes careless he is certain to have bad results.

Amputation of the teat will, in a great many of these cases, save the cow from severe mastitis and perhaps death. When the teat is completely occluded and milk cannot be drawn from the quarter by the aid of teat operations, milk accumulates in the quarter ,serving as an excellent medium for the growth of bacteria. Amputation of the teat allows the milk to escape, thus providing drainage.

When cases of this kind are presented to the veterinarian he should try first to save the teat. If this cannot be done it should be amputated, as soon as it becomes apparent. This will in most instances prevent the extension of the infection and the development of a severe, perhaps fatal, attack of mastitis.

DYSTOCIA IN A MARE

On the morning of April 8th a six-year-old, Percheron mare weighing about 1700 pounds was brought to the Iowa State College veterinary clinic. She was in good physical condition; the pulse and respirations were normal. The history was that she began labor shortly before midnight of April 7th at the termination of a normal gestation period. She had been examined by two veterinarians before being brought into the clinic, but no effort had been made to deliver the foal.

Examination revealed a breech presentation, the foal lying on its left side, both hind legs extending forward.

Embryotomy was begun immediately. The right leg was removed at the hip joint. After considerable effort the saw was placed around the left rear leg and this removed. The pubis and part of the ischium and sacrum were removed with this.

Delivery was then attempted but was impossible, so the fetal cadaver was eviscerated, which facilitated delivery considerably.

Considerable difficulty was encountered throughout the operation due to the ease with which the bladder prolapsed. The urethral orifice would allow easily the passage of three fingers, and whenever the mare strained prolapse occurred. This was replaced easily when the excessive straining ceased.

The entire operation required about two and one-half hours, however, the mare seemed to stand it very well and was resting quitely when it was completed. Examination after delivery had been made revealed a rent about three inches long in the vagina just posterior to the cervix.

About four hours later the removal of the fetal membranes was attempted; but it was decided to leave them in place as they were still firmly attached. They were expelled unassisted sometime during the night.

On the morning of April 9th the mare was very restless, the pulse being almost

imperceptible, and shortly she began straining excessively. This caused a prolapse of the small intestine through the tear in the vagina. The case was pronounced hopeless and 15 grains of strychnine in acetic acid was administered intravenously.

The owner had been advised that delivery was impossible before bringing the mare into the clinic. Often with proper instruments and technic an embryotomy with such a presentation may be accomplished successfully. The prognosis depends largely on the time required for the operation and the amount of injury resulting.

Elwin Coon,
Ames, Iowa. I. S. C. '32.

PASTEURIZATION NOT A SUBSTITUTE FOR TESTING CATTLE

All of the evidence points unmistakably to success in controlling bovine tuberculosis to a large degree in Illinois. This could never have been achieved without the services of veterinarians who have practically eliminated tuberculosis from the herds of Illinois. Clean herds will not automatically remain free from tuberculosis, however. Everlasting vigilance against this disease must be employed to retain the progress which has been gained. Pasteurization of milk will probably never become universal. Even if it should, the element of human error is always present. The loss to stock raisers from tuberculosis could never be prevented through pasteurization. Thus the veterinary and public health professions have before them the perpetual task of maintaining the improvements now enjoyed and of further reducing tuberculosis in man and beast.—Andy Hall, M.D., Director, Ill. Dept of Health.

Method for breaking a halter breaker. The rope encircling the body passes through a hondoo or loop and tightens when the horse pulls back.

SOME OF THE REQUISITES FOR THE VETERINARY PARASITOLOGIST

In order to have a good foundation for his work, the student of Parasitology should first know something about the general classification of animals. Such training is especially desirable, for many of the groups of parasites that are common to livestock are difficult to classify. Familiarity with the International Code of Zoological Nomenclature is also essential in order to avoid the common mistake of creating new groups. There is a need for more stability in nomenclature in this field.

If more time could be given to the special study of the morphology of parasites and to the anatomy of animals, the student would have a better idea of the effect a parasite has on its host; at least he should be familiar with the normal appearance of the digestive tract of farm animals. More study concerning animal diseases, their nature, causes, and results is also important for those who are going to work with parasites. A knowledge of drugs and other remedies for treating diseases might well be included in such training.

The subject of prevention of parasitisms deserves more attention than it receives in most of our schools. It might be a good form of examination to give students sample life histories of all sorts of parasites in all sorts of hosts and ask them to select the weak link in the life cycle at which one might drive, and ask them to propose a method of driving at it. This is precisely the end to which all the work of the Zoological Division aims.

The student who overlooks the value of a foundation in general agriculture should bear in mind the fact that the farms are the battlegrounds where the decisive conflicts for the control of livestock parasites must be fought. The combatant must not only know his ground, but also the customary activities of animal and plant production. A profound ignorance of farming may ser-

iously limit a man or woman's usefulness as a parasitologist.

A good foundation in mathematics, chemistry, and other basic sciences is especially valuable at the present time, since many new fields are being opened up, as, for example, the relations between parasites and foods, or between parasites and bacteria. The student who has had special groundwork in elementary sciences is better able to specialize in these new fields than the person who has neglected this training.

A reading knowledge of at least three foreign languages is a great help to any parasitologist. There are many scientific papers in German, French, Spanish, Japanese, and other languages. The wider the grasp of such languages, the larger field the worker will have for getting new material and information. The person who can not read any foreign language readily, must depend on someone's translation or an occasional English summary or review to give him the information.

It should not be necessary to say that students leaving college should understand the rudiments of English grammar and know how to spell. Since the writing of manuscripts is one of the many details of work in parasitology, it is obvious that common mistakes should be avoided or at least corrected by the author before the paper is submitted for recording or for publication.

Some young M.A.'s and Ph.D.'s who enter the Zoological Division are blissfully ignorant of the basic methods of experimental research. This results largely from the belief of many directors of research that the graduate student should be thrown into a problem and left to sink or swim. The methods of re search, can be and should be taught Parasitology is developing its own technical methods and the student should know not only what methods are used but also that these methods can be improved.

There is a need for a better knowledge of ethics in the professional relations of scientists. The student should be taught that giving credit to another author is sharing responsibility. He should also learn that the courteous things of life are not only pleasant but they are also profitable. One is not actually a member of the fellowship until he is established among his associates on a basis of mutual courtesy. A certain gentleness and consideration in writing of other authors always helps to create good feeling and cooperation.

As a final qualification for a parasitologist, he should have a large capacity for hard and dirty work. Post-mortem examinations are the special occupation of collectors in this kind of work, but it is sometimes difficult to make a collector out of the man with a Ph.D. because often he is too academic-minded or too dignified. One may have to make a post-mortem examination of a dead horse on the prairie in a snow storm, or of a much-too-dead sheep in a stuffy room in the heat of August. Only an insatiable curiosity in one's subject-matter, or unwillingness to abandon an opportunity because of discomfort, will hold one to his task under such circumstances. The person who shrinks from blood or dirt, who pokes at a specimen and reports it in too poor a condition to examine, lacks the heart and mind for work in parasitology. Much of our work is "mucky work" and only real workers can expect to qualify for it.

There are compensations, however, in the many opportunities that veterinary parasitology offers. New developments in the relation of parasites to agriculture are opening virgin fields for research. Only a limited number of students specialize in veterinary parasitology and quite a large proportion of these enter the Federal service. A very definite work for human welfare is performed by this group of workers, and the well-prepared graduate will find there a fruitful field for his endeavors.

Washington, D. C. M. C. Hall.

Congenital Stricture of Teats

By HERBERT M. TABBUT, Ames, Iowa
Veterinary Division, Iowa State College, Class of 1932

MARCH 14, 1932, a red, grade Shorthorn cow aged 2½ years was presented at the Iowa State College veterinary clinc. The cow had freshened about six weeks previously; her second lactation period. She was in good condition, showing no evidence of systemic disturbance. The pulse was 76, respirations 36, and temperature 102° F. These were taken soon after she was unloaded from the truck which accounts for the increased frequency of the pulse and respirations. The appetite was good.

The history indicated congenital stricture of all four teats. She had milked hard since the beginning of her first lactation period. The owner wished to have her treated for mastitis, and to have the strictures corrected at the same time.

Examination of the udder revealed that all four teats milked with a considerable degree of difficulty. Catarrhal mastitis was in evidence in the left rear quarter. Numerous yellow floculi were removed with every stream of milk. Manipulation of this quarter caused little evidence of pain. The orifice of this teat was extremely small.

The cow was placed on the operating table. The teats were washed thoroughly with soap and water and thoroughly dried. Tincture of iodine was applied to each teat. A piece of muslin was sterilized by boiling. Four holes were made in the muslin and the udder completely covered, a teat protruding through each hole. The orifice of each teat was dilated with a conical teat dilator. A sharp, teat bistoury was then introduced into the teat orifice for a distance of about one-fourth inch, at which distance the point of the bistoury was thrust through the mucous membrane. With the tip of the teat firmly grasped in one hand the sphincter was completely severed, and the knife withdrawn. At a point approximately opposite the first incision a second thrust was made through the mucous membrane and the sphincter again severed. This procedure was repeated on two of the remaining teats. All milked easily as soon as the sphincters were cut.

Due to the presence of an active catarrhal mastitis in the left rear quarter, the orifice of that teat was cut wide open with a teat slitter to facilitate drainage, and hence help to overcome the infection. From all teats a few streams of milk were removed at hourly intervals to prevent union of the cut ends of the sphincters.

The mastitis of the left rear quarter improved rapidly, due to the drainage afforded by slitting the teat. The other three teats continued to milk easily, there being practically no soreness manifested during the milking process. Three days after admission the cow was discharged.

Three weeks later the owner stated that the operation was very successful, much to his satisfaction.

Nothing is more provoking to a farmer than a hard milking cow in his herd. At every milking time his patience is taxed. Many a high producing dairy cow is sent to slaughter by the owner, after he tires of the disagreeable task of milking a "hard milker." Here a veterinarian can render a highly appreciated service by correcting cases of stricture of the sphincter.

Strictures of the teat sphincter are of two types: congenital and acquired. Of these, the congenital type is the more easily handled; because in this type inflammation plays no part. The acquired type is the more difficult to treat, and is perhaps the more common. While trauma may at times be the cause of acquired stricture of the teat orifice, by far the most common cause of this condition

is chronic catarrhal inflammation of the wall of the teat canal. This condition brought on by a low grade infection causes a gradual thickening of the mucous membrane and closure of the teat orifice.

A number of suggestions are worthy of note regarding the technic of this operation.

1. There is some danger of causing a "leaker" by slitting the sphincter in more than one place. It is better to operate a second time if necessary than to risk producing a leaking teat, which is difficult to cure. In this case the owner insisted that we correct the strictures at the same time that the mastitis was treated. For the reason that we feared the onset of mastitis in some of the other quarters we cut the sphincters somewhat more than is indicated in the average case.

2. Stricture of the teat orifice is one surgical operation that should be performed on the lactating mammary gland. By so doing, milking at frequent intervals keeps the cut ends of the sphincter from uniting.

3. Do not attempt to sterilize the entire udder; any attempt to do so is wasted effort. It merely results in concentrating the infection on the ends of the teats, where gravity attracts the solution and suspended organisms. The safest procedure is that of cleaning the teats alone.

4. The cow must be restrained completely, in the recumbent position, so that struggling will not interfere with the operation.

5. As in any udder surgery, aseptic technic must be maintained. Absolute asepsis of instruments is best attained by boiling.

Picnic of the Eastern Iowa Veterinary Assn.

SUCCESSFUL REMOVAL OF ABDOMINAL TUMOR IN A DOG

The following is a complete history of a peculiar and rare occurrence which I observed and treated. The subject was a Boston terrier, eleven months old. When brought to my office the animal was in a depressed and weakened condition. His temperature registered 105.5° F., pulse fast and weak and he seemed barely able to stand. The abdomen appeared sunken and very full; on palpation I felt clearly a hard circular mass about the size of a large baseball directly over the umbilical region. A sero-fibrinous exudate oozed from the skin at the umbilicus.

The owner had noticed the swelling during the preceding two or three months but had not sought veterinary advice then as the abnormality did not seem to bother the dog at all. About a week before the animal was brought to me the owner noticed the secretions. It was very scant at first, becoming more abundant later.

I advised an operation immediately, telling the owner it was the dog's only chance and a slim one at that. Consent given, I placed the dog under ether. I made a longitudinal incision through skin, muscle and peritoneum on the median line about four inches long directly over the umbilicus. On opening the abdominal cavity, I found a large cystic tumor. The growth was attached by means of fibrous strands to the outer surfaces of the stomach, liver, spleen and mesentary. My initial abdominal incision was not large enough to permit careful dissection and removal of the tumor, so I enlarged the opening, cutting from the posterior end about three inches at right angles to my first abdominal incision, like the figure L.

The tumor was removed without injury to any of the abdominal organs by dissection with blunt scissors. The wound was closed with two layers of sutures and bandaged.

The dog made a remarkable recovery considering the near state of collapse he

was in prior to the operation, and left the hospital in seven days.

The tumor weighed twenty-two ounces. On cross section the interior contained about an ounce of thick fluid encapsuled by the thick fibrous wall of the tumor. It undoubtedly originated from embryonical vessels at the umbilicus which failed of absorption at birth.

David A. Kreindler.

Brooklyn, N. Y.

GANGRENOUS MASTITIS IN A COW

This case was brought to the Iowa State College veterinary clinic the first week in April, 1931. The cow was a six-year-old, grade Guernsey; reared in the vicinity of Story City, Iowa.

History.—This cow had given birth to an excellent, normal, healthy calf about three days previously. The cow developed milk fever and was treated by inflation of the udder. She was well-bred and a very heavy milker; the owner wanted her saved if at all possible. She showed no improvement on the farm the first two days after calving. When she arrived at the clinic she was in quite a serious condition.

Symptoms.—The cow was given a careful examination. She was off feed, depressed and showed a temperature of 102.8° F. The pulse was rapid and weak, approximately 132 per minute. The respirations were 42 per minute. She lay on her side; it was very difficult to get her to her feet. The udder was much enlarged and hard. The rear quarters of the udder were cold, discolored and showed evidence of gangrenous mastitis. There was a large, edematous swelling just anterior to the udder, and slight constipation.

Diagnosis.—Gangrenous mastitis.

Prognosis.—Guarded but unfavorable.

Course of the Disease

The discoloration of the skin at the base of the two rear teats, extended up the udder, as the case progressed and was followed by cracking and scaling of the skin. Sensitiveness was entirely gone in the discolored area. There was very little hemorrhage on incision. The pulse and respiration remained about the same for the first week. The temperature fluctuated from 102 to 103.6° F. The gangrenous tissue extended to the left front quarter with the skin sloughing in places. Nothing but a few drops of serum could be obtained from the affected quarters by milking. There developed a sharp line of demarcation between the blue, cold, necrotic tissue and the pink, healthy looking skin, the infection having been walled off by phagocytosis. The necrotic tissue completely surrounded the two rear quarters and the left front quarter. The right front quarter was quite normal.

Treatment

Hot packs were applied for the first two days. The following medication was also given daily:

Sodium salicylate, ½ ounce
Boric acid, 2 drams
Fluid extract nux vomica, 2 drams

Some days there was a quite severe diarrhea and no treatment was administered. As the necrotic tissue began to slough away, it was cut out to hasten recovery. Blood vessels that were quite large were ligated to prevent hemorrhage from necrosis. The patient went home in four weeks. The right front quarter was the only one that could be saved.

The cow was of no value for milk production but she was valuable for breeding purposes.

Recovery from gangrenous mastitis following parturition is not common. Amputation of one-quarter or one-half of the udder is a radical operation with a high mortality. When a line of demarcation between the necrotic and the sound portion of the udder is visible, amputation of the necrosed part is indicated. This hastens the separative process, and recovery usually follows. Frequently, however, the cow dies from toxemia before the line of separation between the necrotic and sound structures appears. In such cases early amputation of the affected quarter or quarters is indicated. This operation is followed by a high mortality in such cases.

Roy E. Conaway,

Ames, Iowa. I. C. S. '32.

Malnutrition or Leg Weakness in Baby Chicks*

By A. J. DURANT and H. C. McDOUGLE, Columbia, Missouri
Veterinary Department, University of Missouri

THE accompanying photographs illustrate the extreme condition of malnutrition which may exist in birds and yet the birds recover completely when placed upon a proper diet.

The three birds illustrated in Fig. 1 were brought to the laboratory for diagnosis. The condition was pronounced malnutrition or leg-weakness and an immediate change of ration was recommended for the rest of the flock.

Fig. 1 is from a photograph taken the second day after the birds were received.

Fig. 1. Two weeks old chicks affected with malnutrition. Note not only the bent legs but the crumpled condition of the toes. This condition is due to an improper ration. Such chicks recover completely in an astonishingly short time if a balanced ration is supplied them

It illustrates very well the common form of malnutrition or leg-weakness. Up until that time they had received no food. The next day one of the birds showed a marked improvement and was able to walk, though still somewhat lame. All three birds were put on a balanced ration and a supply of green feed put before them and improvement was soon noted.

Five days after the birds were received, their appearance is shown in Fig. 2. All the birds having made a complete recovery, at that time, were returned to the owner.

If birds affected with malnutrition are supplied with a correct ration within a reasonable time after the deformity of the legs has occurred, they recover in a remarkably short time and have no misshapen legs. If the condition is allowed to continue for some time before a remedy is applied, the muscles, tendons and

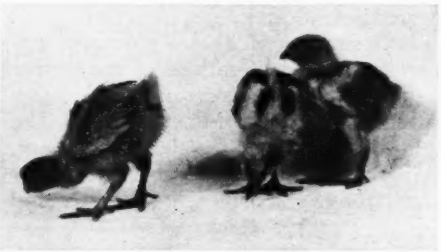


Fig. 2. The same chicks as illustrated in Fig. 1, after they had been properly fed for five days. Note that the legs and toes have resumed a normal position and that all three chicks are able to stand in a correct position. Their recovery is complete

joints become fixed in the misshapen condition illustrated in Fig. 1, and it is not possible to effect a cure as far as getting their legs straight and in a normal position is concerned.

This case is a good illustration of what may be done in this respect. The owner of the flock from which these birds came heeded the advice to put them on a balanced ration and no more cases of leg-weakness developed in it.

*Contribution from the Department of Veterinary Science, Agricultural Experiment Station, University of Missouri, Journal Series No. 343.

Shoulder Tumors in Work Horses

By FRANK ANDERSON, Ames, Iowa
Veterinary Division, Iowa State College, Class of 1932

A FIFTEEN-YEAR-OLD, bay draft horse was brought to the Iowa State College Veterinary clinic recently with a well developed case of shoulder galls, or "bull's eyes," as they are commonly termed by laymen in this locality.

According to the owner the horse had had shoulder sores during the summer season for several years in succession. During the winter they seemed to heal over, but when spring work began, the condition returned. Tumor-like growths of tissue had been developing for some time, especially on the left side. These increased in size every year until they hindered the horse greatly in working, and he had decided to have them removed surgically.

On examination these processes appeared to be proliferations of connective tissue between the skin and underlying muscle at the point of the shoulder. The right one was about the size of a walnut, while the left one was comparatively very large; about six inches in diameter and 1½ or 2 inches thick. The skin over these areas was excoriated somewhat, though partially healed over. Evidence of long-continued irritation was shown by the sparseness of hair and the unhealthy appearance of the skin at these points. On the left side due to formation and contraction of scar tissue, the skin was wrinkled, the folds radiating out from the center.

Because of the sensitiveness of these processes, the operation was performed on the operating table. A local anesthetic (2% apothesine) was injected into the skin around the edge of the left process. Injections were then made into and under the mass of tissue, toward the center from all around the edge. An elliptical incision was made vertically, about six inches long and about two inches wide at the middle. The skin was dissected carefully from the underlying mass of tissue and this mass was then separated from the deeper structures. At one point the brachiocephalicus (levator humeri) muscle was involved slightly, but except for this, separation was quite easily accomplished. This mass of tissue, which weighed one pound, three ounces, was then removed, leaving a large cavity. It has been found by some that healing generally progresses more favorably when these conditions are treated as open wounds. However, in this case the wound was sutured to prevent excessive gaping. A gauze pack saturated with a mixture of iodoform, bismuth subnitrate and liquid petrolatum in the proportion of 1, 2 and 16 was first placed in the wound. Removal of the process on the other side was accomplished in the same manner, the chief difference being in the size of the two incisions. The owner was instructed to remove the packs and sutures after three days.

These conditions are sometimes caused by bruising of the shoulders. This results in a collection of serum which is organized to form fibrous connective tissue masses, unless opened and drained before organization occurs. The connective tissue mass acts as a foreign body underneath the skin. When allowed to rest the surface of the lesion heals, but when worked the lesion again becomes acute. Probably the commonest cause is the use of poorly fitting or poorly adjusted collars and harness. Bruising can also be caused by putting a horse that is unused to work to a hard pull. Breaking colts by putting them on a plow or at other hard work may bring on the condition. The line of draft should be adjusted so that it comes at the point of

least movement on the shoulder. Collars, especially, should be fitted carefully and new collars should be "broken in" correctly. They should be soaked over night in water and put on the horse while wet. Then by putting the horse to a heavy pull for an hour, the collar will adjust itself to the contour of the shoulders of that horse. The collar should then be dried.

The shaking of the skin caused by the annoyance of flies retards healing after operation; hence the best results are obtained from removal in the winter time, since it is important that a minimum of scar tissue be formed during the healing process. Any considerable amount of scar will start the trouble over again.

While surgical treatment is not 100% effective, in the majority of cases, it improves the condition greatly. The operation should not be done while inflammation is acute. In case the owner finds it necessary to use the horse until the rush season is over, an ointment containing ground graphite with an antiseptic is very useful. This preparation acts as a lubricant, reducing the friction between the collar and the irritated skin. The lubricant should be applied before going to work, after cleaning the wound and the collar. The hair around the wound should be clipped so that exudate will not accumulate and cause irritation. When the rush season is over, and the acute inflammation has subsided, surgical removal can be accomplished. A more modern treatment is the use of pyoktanin (or methylene) blue in alcohol instead of the lubricant. Being strongly astringent, it lessens masceration of the skin and makes it more resistant to injury from friction by the collar.

AMPUTATION OF THE CLAW IN THE PIG

A large Berkshire boar weighing 800 pounds, belonging to the Farm Department, Iowa State College, was presented for treatment at the college clinic.

The boar had been lame for two months; finally becoming so lame that it would not get up to eat. There was a large, painful swelling around the fetlock region of the left front leg, involving especially the lateral toe.

Diagnosis—Necrosis of the joint between the first and second phalanges of the lateral toe of the left front leg, probably caused by a penetrating wound.

Treatment—The boar was placed upon the large animal operating table and properly restrained. The area about the fetlock and the lateral toe of the left front leg was thoroughly cleaned, shaved, and painted with tincture of iodine. It was then infiltrated with a 2% solution of apothesine. Care was taken to infiltrate thoroughly all around in the deeper tissues next to the bone of the first phalanx. An incision was then made on the anterior side of the toe, beginning well up on the first phalanx, and continuing downwards to the coronary band. A similar incision was made on the posterior surface of the first phalanx. Both these incisions extended to the bone. Next an incision was made completely encircling the toe, just above the coronet.

The flap of skin and tissue on the lateral side, isolated by the above incisions, was now dissected from the first phalanx up to the middle of the bone, and deflected out of the way. The first phalanx was dissected away from the tissues on its medial side and a wire saw used to sever the bone at the junction of its middle and lower thirds. A "bipp" pack was placed over the stump of the bone, the flap of the skin drawn down over it and sutured, leaving a small opening at the bottom for drainage. A bandage was wrapped around the foot and the boar returned to the box stall.

After Treatment—On the third day the bipp pack was removed. The wound was kept bandaged to protect it from dirt. This bandage was changed every three days. For

a few days the boar had to be forced to his feet but once up would eat and drink as usual. An uneventful recovery followed.

Discussion—This operation is relatively common in the ox but rare in the pig. The same technic was followed as in the ox. The after-care was the same, with the exception that the pig, especially the male, is very liable to give up completely when suffering pain. Due to this the pig had to be forced to get up or he would have lain on his side and starved to death.

Ames, Ia. Lloyd Thomsen,
I. C. S. '32.

A NEW FLAVOR AND ODOR FOUND IN MILK

During the latter part of February, 1931, there came to us from a herd in Topsfield, Mass., a sample of milk having a very peculiar "chocolate-carboardy" flavor and odor. The available literature brought forth no information concerning such a condition. A visit to the farm revealed that due to inadequate ventilation, moisture had collected on the hay and at one end of the milking portion of the barn, resulting in a decidedly moldy condition. A few of the cows were moved to another barn, and new clean feed was used, and different milking utensils were employed, but these precautions failed to eliminate this undesirable flavor and odor. Thus we concluded that the moldy condition of feed and air in the barn was not responsible for the conditions found in the milk.

A bacterial check on production methods followed at the farm. This showed that the utensils used were very clean from a bacteriological standpoint. The average bacterial count of 10 cans of milk produced in one day was 1790 per c.c. of milk. Samples taken immediately after milking the first cow with each of two milking machine units average 1350 bacteria per c.c. of milk.

As soon as the milk was drawn it was cooled over a surface cooler to 42° F. and stored in a wet type electric milk storage tank at 38° F. Due to the small number of bacteria present and the rapid cooling and low holding temperature, it does not seem possible that there could be a normal amount of acid produced.

This peculiar flavor and odor became noticeable in 24 hours at cold storage temperature (38-40° F.) but in samples set at room temperature it became perceptible after 12 hours. We assumed then that this trouble was caused by a type of bacteria that could grow in the absence of an acid medium and between wide ranges of temperature.

From a sample of this affected milk, plated on media having a pH of 7.2 there was isolated a coccus type of organism, resembling very much in character the staphylococcus organism usually found in milk coming from cows troubled with mastitis. This organism appeared to be somewhat larger than the usual mastitis organism.

The history of the herd revealed, and a clinical examination showed that the herd had had mastitis, undoubtedly chronic in character. This led us to believe that possibly mastitis was indirectly responsible for the milk having this peculiar flavor and odor. From this organism which was isolated, an autogenous bacterin was made, and used on this herd. This seemed to give negative results.

Sterile milk inoculated with this organism, duplicated the "chocolate-carboardy" flavor of the originally affected milk.

With the coming of spring the "chocolate-carboardy" flavor and odor did not continue to develop in the milk, and this led us to believe that it was not particularly serious.

We understand, however, that this condition re-occurred at intervals during this past winter and that this same puzzling and unsolved problem has been encountered in other localities. This recurrence has made us consider it in the light of a more serious menace. It has, in fact, opened a new channel for investigation and research.

C. L. Martin,
H. C. Moore.

N. H. Exp. Sta.,
Durham, N. H.

Pullorum Disease Infection of the Leg Joints in Baby Chicks*

By A. J. DURANT and H. C. McDOUGLE, Columbia Missouri
Veterinary Department, University of Missouri

A flock of chicks which according to the history given the authors began to die at the age of a week were seen when they were three weeks of age.

These chicks varied greatly in size as shown by the accompanying illustration (Fig. 1). It will be noted that though the chicks are all of the same age, that the two in the center are practically the same size as when they were hatched, the others being well grown chicks. A pure culture of *Salmonella pullora* was isolated from the two small chicks.

One of the larger chicks shown in Fig. 1 is shown in Fig. 2. It can be seen that the tibio-metatarsal joint is enlarged, red and inflamed. A pure culture of the organism causing pullorem disease was isolated from the swelling, under the skin and from the joint fluid. A pure culture of the organism was also isolated from a very small unabsorbed yolk from this same chick.

It is likely, therefore, that this chick was infected at an early age and that the infection localized in the joint and caused the swelling.

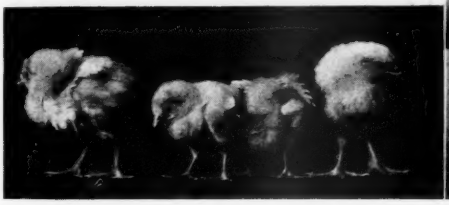


Fig. 1. A group of chicks affected with chronic pullorum disease. All four chicks are of the same age and the same hatch. Note the difference in size of the two chicks in the center. The bird on the left is illustrated again in Fig. 2

*Contribution from the Department of Veterinary Science, Agricultural Experiment Station, University of Missouri. Journal Series No. 342.

The same condition was found in another flock of chicks on a different farm. In this case, the swollen joint was accompanied by a twisted and deformed leg. The *S. pullora* was isolated in pure culture from the swollen tibio-metatarsal joint from this chick also.

These two cases of joint infection illustrate that other things than leg weakness, slipped tendons or rickets may be responsible for lameness in baby chicks, and that one should not assume that the chicks are affected with some form of malnutrition, without proper and definite diagnosis being made. It may be that in the past, cases of pullorem disease infection of the joints have been diagnosed as slipped tendons or leg weakness.

Fig. 2. A bird from the illustration in Fig. 1 showing enlarged tibio-metatarsal joint of the left leg from which a pure culture of Bacterium pullorum was isolated

UNDULANT FEVER INCREASING

In 1929, eighteen cases of undulant fever were reported in Illinois; in 1930, 61 cases were reported, and in 1931, 124 cases.

Mastitis with Metastatic Abscesses

By RAMOND L. JOHNSON, Ames, Iowa
Veterinary Division, Iowa State College, Class of 1932

A GRADE Holstein cow weighing about 1,000 pounds, in rather poor condition, presented to the Veterinary clinic of the Iowa State College with the history of having had a swollen udder for a week. The owner stated she had evidenced "indigestion" for nearly a month.

Symptoms

Atony of the rumen, swelling of the udder, diarrhea, depression, emaciation, shallow breathing, and a fast weak pulse. Cultures and smears were made from samples of milk. These revealed a few staphylococci and many short chain, nonhemolytic streptococci. Considerable bloody milk was obtained from the left hind quarter. Milk from the other quarters appeared normal.

Course

The left hind quarter became edematous and hard in the early stages of the disease. The material obtained from the infected quarter gradually changed from a sanguinous fluid to a grayish watery substance. It was necessary to give rumen stimulants occasionally, but the rumen was usually in fair condition. After being in the hospital ten days the cow exhibited a thick mucus discharge (very offensive) from the nostrils. This developed a sanguinous character, and later turned to an odorless purulent exudate. In two weeks time the cow showed general toxic symptoms such as inappetance, quite rapid emaciation and a weak heart. At this time metastatic abscesses appeared and were opened. However, emaciation continued and within a week the cow was so depressed that she could not stand on her feet. She became weaker rapidly and died two days after going down.

Treatment

a Medicinal.—The cow was given 12 quarts of mineral oil followed by subcutaneous injections of ¾ grain doses of eserine salicylate every two hours. This was kept up for three periods. On each of the following two days, twenty gallons of water were given by means of a stomach tube.

b Physical.—Hot packs were applied to the udder for a period of a month. A special soaking apparatus was used, by means of which hot water was kept on the udder for about two hours daily. The cow was milked out four times daily throughout the period of treatment.

c Surgical.—Swellings appeared on the dorsal side of the neck and near the left hip. These were opened and considerable pus was obtained from each. The one on the neck discharged for nearly ten days and had healed at the end of two weeks. It was impossible to establish drainage for the deep abscess, near the hip joint, consequently healing did not take place. At the end of one month the cow was not showing improvement, so a teat amputation seemed to be indicated. The cow was placed on the table and local anesthesia used. The teat was removed and also a large amount of necrotic gland tissue. A gauze pack soaked in bipp was placed in the cavity and held in place with a suture of catgut.

Autospy Findings

The infection in the left rear quarter of the udder had extended so that the parenchyma was entirely gangrenous, while the rest of the udder showed no infection. A chronic catarrhal enteritis with the usual thickening of the mucosa was the only lesion in the digestive tract. A mild peritonitis with adhesion of the liver to the diaphragm was present. The lungs were somewhat congested but no abscesses were found, and considerable normal lung tissue was present. The kidneys showed some nephritis and cloudy swelling. The liver was very hard and indurated, probably due to connective

tissue growth caused by the constant absorption of toxins. The spleen was of the same consistency as the liver, showing connective tissue proliferation. There was also cystitis and metritis, the latter being very marked.

Summary

This case is of interest because it is somewhat typical of a mastitis caused by a toxin forming, non-hemolytic streptococcus. No bacterin was used.

It was evident that pyemia caused the rapid emaciation of the cow.

Physical therapy, heat and frequent milking proved of no value in this case.

Mastitis is a very prevalent disease among dairy herds and curative treatment is a very difficult proposition. Many cows have been sent to market because of it, while others do not even get to the market. It may be classed as a filth disease and sanitation is the best preventive we have at the present time. The diagnosis of mastitis is not difficult and herdsmen should be instructed to secure veterinary advice at the very onset of swelling in the udder or the appearance of lumpy milk.

TUBERCULOSIS OF CHILDREN ON THE DECLINE

The influence of control measures applied to bovine tuberculosis can be measured with considerable accuracy. Bovine tuberculosis in humans is confined very largely to children under five years old. Twenty-five years ago, 6% of all deaths from tuberculosis in Illinois were among children in that age group. In 1930 only a trifle over 3% were among children under five. The actual number of deaths from tuberculosis among children under five years old has declined from about 450 to about 150 per year within a quarter of a century. Most of this decline has occurred during the last decade.

This indicates more than 300 fewer deaths per year in a population much greater than that of 25 years ago. Since for each death there remains nine or ten cases of the disease, the improvement includes the prevention of some 3,000 cases of childhood tuberculosis per year in Illinois. To what greater service to mankind could any man devote his time and energy?—Andy Hall, M.D., Director, Ill. Dept. of Health.

FOOD POISONING IN SWINE

Please give me your opinion and possible diagnosis on a herd of hogs as follows:

Herd consisted of eleven sows and 58 pigs from five to seven weeks old. The sows were immunized last year; have been fed on the same feed for the last two months, which consisted of soaked barley and a small amount of oats, milk and water. These sows and pigs had access to a blue grass pasture. There were some weeds in the pasture, but few if any were eaten and as a matter of fact the hogs were in the pasture very little. Saturday evening, the hogs were fed barley that had been put to soak 36 hours previously. The sows and pigs ate as usual and were apparently normal. The next morning five sows were down, four of them being in a state of coma, and one was extremely nervous, evidenced by continued struggling. Two sows were walking all of the time, but going no place, they were apparently blind and ran into posts, buildings, etc. The other four sows and most of the pigs were dull, depressed and dopey. The temperature of the affected sows was normal or a little subnormal. Other hogs in the same pasture but not being fed the same feed were not affected. One sow had died during the night but was not autopsied. Any information will be appreciated.—A. M. D.

Reply: It is significant that there were two different groups of hogs on this farm and that sickness occurred in one group that received certain feed and that there was no visible evidence of disease in the other lot. Also, the ailment affected practically all of the hogs within 12 hours. This is strong evidence of a food disorder. The causative factor was apparently in the feed and may have been due to some chemical, fermented products, or fungi. Should there be any further deaths it would be advisable to make a careful autopsy as lesions may be found that will aid in making a specific diagnosis.

A. T. K.

Critical Experiments with Solid Carbon Disulphide Capsules for the Treatment of *Gastrophilus* spp. in the Horse

By JOHN BOZICEVICH and PAUL C. UNDERWOOD, Washington, D. C.
Zoological Division, U. S. Bureau of Animal Industry

Introduction

Recently, there has been developed a new capsule containing carbon disulphide (CS_2) adsorbed in magnesium carbonate ($MgCO_3$) for the treatment of horse bots. At the time the present experiments were conducted, there was no critical information available on the efficacy of such capsules for the removal of bots and it seemed desirable to obtain basic information on this point.

Perroncito and Bosso[1] were the first to use carbon disulphide for the removal of bots. Hall, Smead and Wolfe[2] tested the drug and found it to be effective for the removal of bots and ascarids when used in doses of four to six drams. Hall and Avery[3] later found the drug to be effective in single doses of six drams without purgation or when followed by purgation several hours after administration. The administration of carbon disulphide with linseed oil resulted in reduced efficacy. Thorp, James and Graham[4] have reported recently on the efficacy of the solid carbon disulphide capsules. These workers found that the solid capsules were less effective than was liquid carbon disulphide.

Solid carbon disulphide capsules are designed with a view of obviating the danger of inhalation of the drug when capsules are broken in the mouth. When the liquid drug is marketed in hard gelatine capsules, the capsules become brittle with age and when administered are easily broken. A review of the literature reveals few reports of such accidents actually causing death of the treated animal, although there is a distinct danger from this source. Morin[5] has recently stated that so far as he is aware, no fatalities have resulted in Illinois from the breakage of carbon disulphide capsules in the mouth of the horse. An anonymous report in the Jen-Sal Journel, 1924, V. 3, April, p. 12, gives information to the effect that in one case where a capsule containing liquid carbon disulphide was broken in the mouth, the liquid ran out of the nostrils of the animal. The animal showed no immediate reaction and four hours later was given another capsule. At this time the animal was breathing hard and fast; it later died of mechanical pneumonia.

The potential danger from the administration of carbon disulphide in capsule can be obviated by the use of the stomach tube, but in horse parasite campaigns where daily large numbers of animals are treated, the use of the stomach tube requires more time than can be allotted to the dosing of a single animal. The advantages of a capsule which would eliminate danger of inhalation of the drug are entirely obvious provided such a capsule would still retain the high degree of efficacy exhibited by the liquid carbon disulphide.

Protocols of Experiments

Horse 455, a grey gelding about 18 years old, in thin condition, and weighing 1,225 pounds, was fasted for 24 hours before treatment. No preliminary purgation was given. The animal was given a capsule containing eight fluid drams of carbon disulphide adsorbed in magnesium carbonate. Food and water were withheld for four hours after administration of the drug. The animal was kept in a separate stall and feces were gathered daily for two weeks and examined for bots and ascarids, but none were recovered. At the end of the two weeks, the animal was killed and autop-

sied. No bots nor ascarids were recovered. The stomach showed numerous raised, eroded areas varying from the size of a pea to that of a hazel nut. The small intestine showed organized, fibrous areas apparently chronic in character and not due to the drug. No conclusions could be drawn from this experiment.

Horse 461, a grey gelding about 12 years old and in fair condition, weighing 1,125 pounds, was treated in a similar manner, except that a solid capsule containing seven fluid drams of the drug was administered. No bots were recovered from the feces and none were found present upon necropsy; the conclusion was that the animal harbored no bots at the beginning of the experiment. The stomach showed two small, inflamed, raised areas, apparently not associated with the treatment.

Horse 497, a black gelding about 15 years old, in fair condition and weighing 1,426 pounds, was fasted for 24 hours and was given solid capsules containing 10 drams of the drug. No bots or ascarids were passed and none were found on necropsy. The stomach and intestines were normal.

Horse 222, a black gelding about 14 years old, in thin condition, and weighing about 840 pounds, was fasted for 24 hours as in previous experiments, but, in addition, food and water were withheld for two hours after treatment. One capsule containing six drams of carbon disulphide adsorbed in magnesium carbonate, was administered. There was no reaction to the treatment. No bots were recovered from the feces and none were found on necropsy. The stomach and intestines were normal.

Horse 111, a sorrel gelding about 18 years old, in thin condition and weighing about 1,000 pounds, was given the same treatment as Horse *222*, except that one and one-half capsules, a total of nine drams of the drug, were administered. There was no reaction to the treatment. Feces were collected daily and examined for bots and ascarids. The results are given in the following table:

Results of Treatment for Horse No. 111

Date feces passed 1931	Bots recovered from feces			
	Total No.	*G. nasalis*	*G. intestinalis*	Comments
3–31				
4– 1	30	9 (all mature)	21 (2 half-grown)	Did not eat oats, ate hay; ate well; no symptoms.
4– 2	17	5 "	12 (all mature)	
4– 3	29	11 "	18 "	
4– 4	22	12 "	10 "	
4– 5	(Sunday-feces collected with Monday's)			
4– 6	10	5 (all mature)	5 (all mature)	
4– 7	10	4 "	6 "	
4– 8	3	2 "	1 "	
4– 9	8	7 "	1 "	
4–10	24	17 "	7 "	
4–11	5	4 "	1 "	
4–12	(Sunday-feces collected with Monday's)			
4–13	9	7 (all mature)	2 (all mature)	
4–14	None			
Totals	167	83	84	

Post-mortem Record

The animal was killed on April 14, 1931, by shooting through the head.

Parasites recovered: Stomach—*G. intestinalis,* none; *G. nasalis,* 10, attached to stomach, all alive and all mature.

Efficacy of Treatment

The treatment was 94.4% effective for all bots; 100% for *G. intestinalis;* 89.2% for *G. nasalis.*

Horse 333, a brown gelding about 18 years old, in poor condition and weighing 830 pounds, was given the same treatment as Horse *222*. There was no reaction to the treatment. Feces were collected daily and examined for bots and ascarids, with the results shown in the following table:

Results of Treatment for Horse No. 333

Date feces passed 1931	Bots recovered from feces			
	Total No.	*G. nasalis*	*G. intestinalis*	Comments
3–31	None	.....	.....	Did not eat oats; ate hay. Ate well; no symptoms.
4– 1	None	.....	.....	
4– 2	None	.....	.....	
4– 3	None	.....	.....	
4– 4	None	.....	.....	
4– 5	(Sunday-feces collected with Monday's)			
4– 6	None	.....	.....	
4– 7	None	.....	.....	
4– 8	None	.....	.....	
4– 9	1	1 (mature)	.....	
4–10	None	.....	.....	Animal in a position of decubitis from pneumonia*
Totals	1	1	.....	

*This experiment was terminated before the allotted two weeks had passed because of the condition of the animal. The animal was in very bad condition at the time of treatment; the treatment was in no way responsible for the pneumonia.

Post-mortem Record

The animal was killed on April 10, 1931, by shooting through the head.

Parasites recovered:

Stomach—None.
Small Intestine—*G. intestinalis,* 2, both alive.
Cecum—None.
Large Colon—*G. intestinalis,* 1, dead.
Small Colon—*G. nasalis,* 1, dead.

Pathology

Lung—Pneumonia.
Stomach—Normal.
Small Intestine—Slightly inflamed.
Large Intestine—Normal.
Cecum—Normal.

Efficacy of Treatment

The treatment was 60% effective for all bots; 33.3% for *G. intestinalis;* 100% for *G. nasalis.*

Horse 444, a brown mare about 15 years old, in poor condition and weighing 800 pounds, was given the same treatment as Horse 222. There was no reaction to the treatment. Feces were collected daily and examined for bots and ascarids, with the results tabulated below:

Results of Treatment for Horse No. 444

Date feces passed 1931	Bots recovered from feces			
	Total No.	*G. nasalis*	*G. intestinalis*	Comments
3–31	None	.....	.....	Eating, no symptoms.
4– 1	None	.....	.....	
4– 2	9	5 (all mature)	4 (all mature)	
4– 3	2	2 "	.....	
4– 4	3	3 "	.....	
4– 5	(Sunday-feces collected with Monday's)			
4– 6	1	1 (mature)		Animal down and had to be destroyed*
Totals	15	11	4	

*Caused termination of experiment before two weeks had passed. The treatment was in no way responsible for the weakness and debility of the animal.

Post-mortem Record

The animal was killed on April 6, 1931, by shooting through the head.

Parasites recovered:

Stomach—*G. intestinalis,* 15, alive; *G. nasalis,* 5 alive, all full-grown.

Small Intestine—*G. nasalis,* 2, alive, partially grown; *G. nasalis,* 1, dead, full-grown.

Cecum—None.

Large Colon—*G. intestinalis,* 130, full-grown, all dead; *G. nasalis,* 194, dead, all full-grown with exception of one, which was only half-grown.

Small Colon—*G. intestinalis,* 7, full-grown, all dead; *G. nasalis,* 7, full-grown, all dead.

Efficacy of Treatment

Total bots killed by treatment.....354
Total bots not killed by treatment..... 22

Total number present.....376

Efficacy of treatment—94.1% for all species

G. intestinalis killed.....141
G. intestinalis not killed..... 15

Total number present.....156

Efficacy of treatment—90.4% for *G. intestinalis*

G. nasalis killed.....213
G. nasalis not killed..... 7

Total number present.....220

Efficacy of treatment—96.8% for *G. nasalis*

Pathology

Stomach — Chronic inflammation over glandular portion, but not believed to be due to drug.

Small Intestine—Normal.

Large Intestine—Normal.

Cecum—Normal.

Discussion

From the results of the present experiments it would appear that solid carbon disulphide capsules have a varied efficacy. In Horses 111 and 444, the capsules showed respective efficacies of 94.4% and 94.1%; in Horse 333 an efficacy of only 60% was obtained. Thorp, James and Graham[4] in their tests with solid carbon disulphide capsules secured respective efficacies of 80% for solid carbon disulphide capsules and 96% for liquid carbon disulphide. As liquid carbon disulphide usually gives an efficacy of 100% against bots, their results show a deviation of 16% between the efficacy of the solid carbon disulphide and that of the liquid drug. The difference in our tests was 40% in one animal and approximately 6% in two other animals. In the present tests, capsules marketed by two different firms were used. There was no appreciable difference in the efficacy of capsules from the two sources.

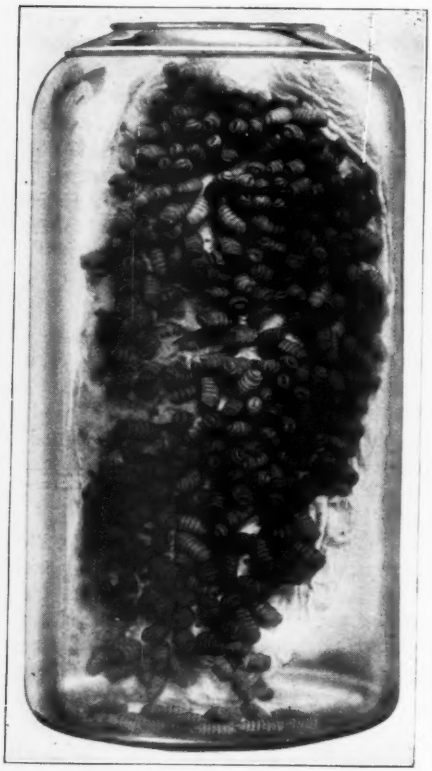
The reaction to treatment with solid carbon disulphide capsules was similar to that of the liquid drug. The animals lost their appetite for the first day but regained it the second day and appeared normal throughout the remainder of the experiment, insofar as the effects of the treatment were concerned.

It is apparent that carbon disulphide adsorbed in magnesium carbonate is not so effective for the removal of bots as is liquid carbon disulphide. The probable reason for this reduced efficacy is that carbon disulphide decomposes into hydrogen sulphide which is liberated.

A recent anonymous discussion in the Jen-Sal Journal, November, 1931, p. 9, states that it is practically impossible to effectively seal capsules containing carbon disulphide adsorbed in magnesium carbonate. Escape of the drug takes place on standing and users of this product are cautioned to weigh the capsules before use in order to make sure that no marked escape of the liquid has taken place. Carbon disulphide acts on hard gelatine capsules in such a manner as to make gelatin extremely brittle in a relatively short period of time. Such capsules are very easily broken in administration. The results following the use of mass carbon disulphide capsules in territories where bot eradication has been carried on extensively have not been entirely satisfactory. One Iowa veterinarian reported that the results were so unsatisfactory with the mass capsules that he was

obliged to re-treat 200 horses with the liquid carbon disulphide.

In view of this report, an experiment was undertaken to determine whether or not carbon disulphide evaporates from the solid capsules. All capsules were weighed when received fresh, or presumably fresh, from the manufacturers and were found to average about 40 grams each with a maximum variation of four to five grams. After standing for a period of approximately eleven months, some of the capsules were reweighed and the weights were as follows: 24, 37, 35, 39, 26, 10, 10, and 22 grams, respectively. This shows that a varying amount of carbon disulphide had escaped. This may be due to the individual sealing of the capsules. The capsules, after a period of eleven months, showed a yellowish tint or color and when tested with lead acetate, hydrogen sulphide was found to be present, showing that the carbon disulphide had decomposed. Fresh carbon disulphide will not give the test with lead acetate for at least 16 hours after the test has been made. The capsules weighing 10 grams were very brittle and had cracked.



Section of a horse's stomach showing gastrophilus larvae in situ.—Photo by Maxfield.

Summary and Conclusions

Critical tests were conducted on seven horses with capsules each said to contain six fluid drams of carbon disulphide adsorbed in magnesium carbonate, administered at the rate of one capsule or more per 1,000 pounds of body weight. Four of the animals were found to harbor no bots. In the other three animals, the treatment resulted in respective efficacies against bots of 94.4%, 60% and 94.1%.

Solid carbon disulphide capsules become brittle with age and crack. Over a period of eleven months there was a marked loss of weight in such capsules due to decomposition of carbon disulphide and the escape of hydrogen sulphide, the presence of which was indicated by the lead acetate test.

The efficacy of fresh solid carbon disulphide capsules for bots is inferior to that of liquid carbon disulphide, and the liquid drug should be the preparation of choice for the treatment of *Gastrophilus* spp. in the horse. Care should be taken to see that the capsules used are still flexible and not brittle.

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